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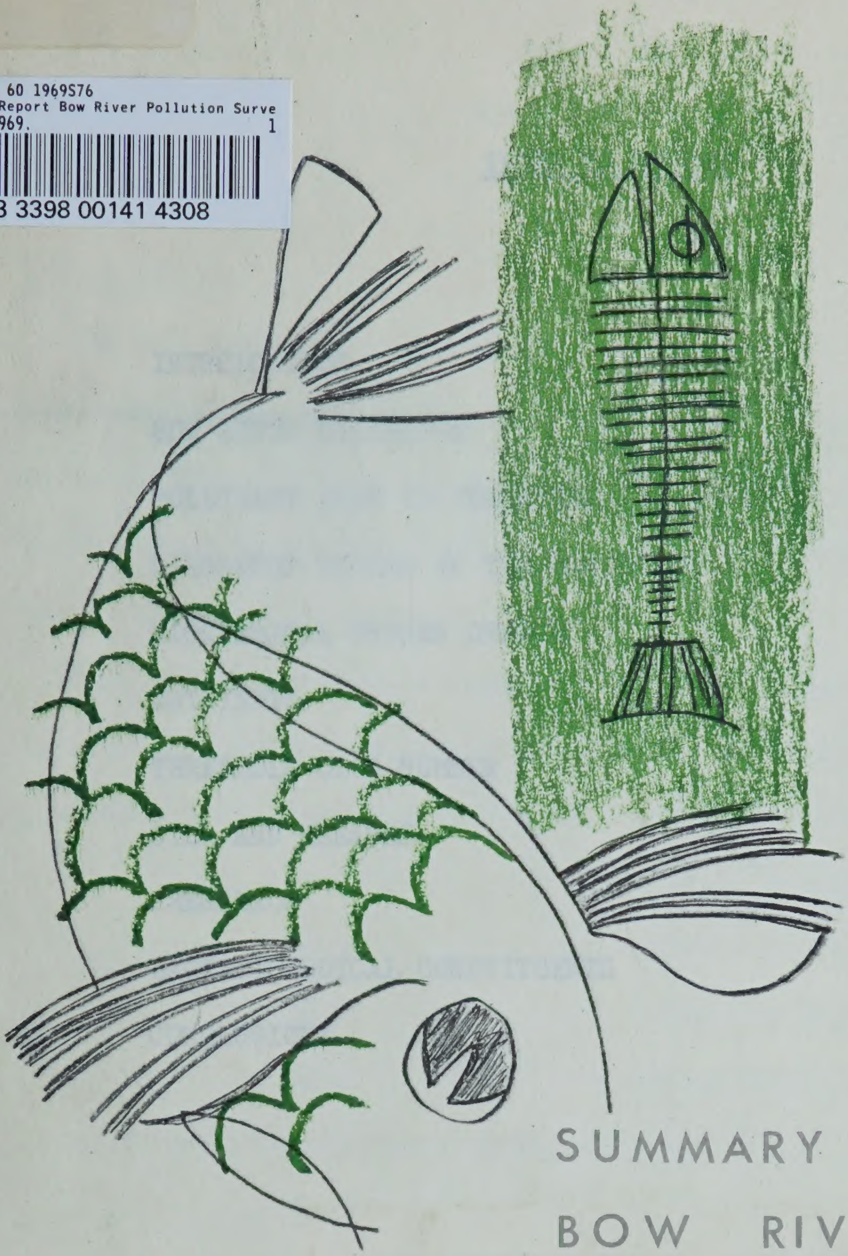

SUMMARY REPORT
BOW RIVER
POLLUTION SURVEY
1968-1969

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SUMMARY REPORT
BOW RIVER
POLLUTION SURVEY
1968 - 1969

INTRODUCTION

The Bow River is used primarily as a source of water supply and as a receiving water for the disposal of municipal and industrial wastes. This river is characterized by two major traits which affect the disposal of pollutants. These two traits are diurnal variation in the summer and heavy ice cover in winter.

This report presents a summary of the sampling conducted on the Bow River during the period from August 13, 1968 to February 19, 1969. The following locations were used as a source of samples and reference: (Figure 1)

BR 1	Cushing Bridge - Calgary
BR 2	Stier's Ranch
BR 3	Bridge on Highway 24 near Carseland
BR 4	Bridge south of Cluny

Additional samples were taken at:

BR 6	Bridge on Highway 36 south of Brooks
BR 14	Bridge south of Cochrane
BR 15	Bear's Paw Dam
BR 16	Baker's Hospital

Sheep River

SR 1	Sheep River at Okotoks

South Saskatchewan River

SS 1	S. Saskatchewan River at Medicine Hat
SS 2	S. Saskatchewan River at Empress

OW RIVER DISCHARGE

The Bear's Paw Dam provides regulation of the Bow River by release from ts storage capacity. Daily flows in the Bow River at Calgary, (Station No. BH-4) from the period of October 1, 1968 to March 31, 1969 are presented in igure 2. Mean monthly flows, maximums, and minimums are also shown in Figure 2.

Ice cover on the Bow River commenced November 16, 1968 and lasted until pril 9, 1969. During these months, the maximum average montly flow ccurred during October (2900 c.f.s.). The minimum mean monthly flow was 380 c.f.s. during November. Minimum daily or critical flow occurred on ovember 21-22, 1968 and March 30-31, 1969 (1020 c.f.s.).

Flow in the Bow River during the sampling surveys ranged from 1020 c.f.s. o 4980 c.f.s.. Figure 3 presents a statistical flow analysis for the Bow iver at Calgary. Twelve years of data were used to compute this graph. t can be seen from Figure 3 that the river flows for 1968 were generally ower than the average flow.

During the year of 1968, it can be seen from Figure 3 that, for one percent f the time, the flow in the Bow River was less than 1040 c.f.s. and, for ten ercent of the time, the flow was less than 1350 c.f.s.. Figure 3 also shows hat, over the past 12 years, for one percent of the time the flow in the Bow iver was less than 1150 c.f.s. and for ten percent of the time the flow was ess than 1680 c.f.s..

OLLUTANT LOAD TO THE RIVER

Both municipal and industrial wastes are discharged into the Bow River t Calgary. The three sewage treatment plants in Calgary (Bonnybrook, Ogden, nd Fish Creek) discharge sewage after the wastes have undergone primary treatment. Four major industries also discharge waste products to the Bow River.

Table I presents the total loadings of various contaminants to the Bow River from Calgary sources. This data is based on the analyses of samples collected during sampling periods and is representative of the pollutant load imposed upon the river. The total load of Biochemical Oxygen Demanding materials ranged from 58,700 lbs/day to 84,300 lbs/day during the eleven sampling days.

Phenolic loads to the Bow River ranged from 12.1 lbs/day to 36.4 lbs/day. On September 12, the concentration of phenolics in the Bow River at Stier's Ranch was 13 parts per billion (or 350 lbs/day) while on December 17, the phenolic concentration at Carseland was 25 parts per billion (or 64 lbs/day). Ammonia-nitrogen loadings to the Bow River ranged from 8,000 lbs/day to 16,500 lbs/day.

Parameters such as Dissolved Oxygen, Biochemical Oxygen Demand, Total Solids, and Nutrients vs. distance downstream of Calgary are presented in Figure 4 to 15.

DISSOLVED OXYGEN IN THE BOW RIVER

Probably the most significant factor in determining the health of a river is Dissolved Oxygen. Not only is this parameter important from the viewpoint of the survival of fish and other biological systems but also from the aesthetic and recreational aspects.

The Dissolved Oxygen content of the Bow River at Cushing Bridge can be considered as representative of river conditions upstream of Calgary and in nearly all cases during the survey, the Dissolved Oxygen in the water was very near saturation.

Table II presents the Dissolved Oxygen data at Stier's Ranch. This data is also represented graphically in Figures 16 to 20. The graphs show a wide fluctuation in the Dissolved Oxygen; however, this is due to the photosynthetic

. . . . 4

action of the weeds in the river when there is no ice cover and also due to the diurnal variations in the volume and strength of domestic sewage.

In general, the Dissolved Oxygen values remained at a relatively high level through the winter months and the lowest value observed was 5.9 mg/l on November 19, 1968 at Stier's Ranch. (A minimum value of 2.1 mg/l was observed September 4, 1968 during the RM - 25 Robot Monitor Survey).

BIOCHEMICAL OXYGEN DEMAND

On Table II and Figure 16 to 20, the Biochemical Oxygen Demand data is presented. When organic matter is introduced into the Bow River, biological activity increases and a high oxygen demand is exerted. Figures 16 to 20 show a high Biochemical Oxygen Demand level corresponding to a low Dissolved Oxygen level, or a low Biochemical Oxygen Demand level corresponding to a high Dissolved Oxygen level.

The Dissolved Oxygen sag curve (see Figure 8) along the river is clearly emphasized and the resultant level of Biochemical Oxygen Demand depicted.

The maximum Biochemical Oxygen Demand level recorded was 7.9 mg/l at Stier's Ranch (3:00 a.m. October 22, 1968). The minimum Biochemical Oxygen Demand con- centration was 0.4 mg/l at Cushing Bridge (November 19, 1968).

NUTRIENTS

Of particular significance in the Bow River is the nutrient level (i.e. Nitrogen and Phosphorous). Ammonia-nitrogen and Phosphates vs. river distance downstream from Calgary are plotted on Figures 4, 6, 8, 10, 12 and 14.

It can be seen that the level of nutrients (Both ammonia-nitrogen and phosphates) in the Bow River is excessively high. At Stier's Ranch, the average concentration of phosphorous as PO_4 was 0.71 mg/l while the average concentration of ammonia-nitrogen was 0.92 mg/l. The maximum recorded concentrations of ammonia-nitrogen and phosphorous as PO_4 were 2.0 mg/l and

. . . . 5

1.5 mg/1 respectively. The continuing industrial and population expansion in Calgary indicates that significant increases in pollution by nutrients will occur and it appears that strict control of these nutrients will have to be maintained.

These nutrients cause excessive aquatic plant life to grow. Excessive plant life in the Bow River is causing large daily fluctuations in dissolved oxygen during the summer season.

THRESHOLD ODOR NUMBER

No significant problems of odor were encountered in the river during the survey period. Odor values of 8 - Musty were recorded at Cluny for three of the five surveys.

OILS & GREASES

The highest value of Oils & Greases monitored was 12.8 mg/l on August 15, 1968 at Stier's Ranch. The next highest value recorded was 5.6 mg/l, also at Stier's Ranch. Both these values seem to be excessive.

Concentration of Oils & Greases at Stier's Ranch ranged from 0.1 to 12.8 mg/l; at Carseland, 0.1 to 2.4 mg/l; and at Cluny 0.0. to 2.1 mg/l.

PHENOLICS

The range of concentration of Phenols at Cushing Bridge was 0 to 6 p.p.b.. However, the ranges of phenolic concentration at other locations were: Stier's Ranch, 1 to 15 p.p.b.; Carseland, 0 to 25 p.p.b.; and Cluny, 0 to 7 p.p.b.. Phenolics in concentrations greater than 5 p.p.b. are undesirable because they impart a taste to drinking water supplies.

The maximum value of 25 p.p.b. at Carseland occurred December 17, 1968. This corresponded to relatively high Phenolics throughout the entire Bow River basin (Figure 9) and low flows (1350 c.f.s.).

. . . . 6

BACTERIOLOGICAL CONSTITUENTS

Bacteriological tests were also included in the 1968 - 1969 winter surveys. Figure 5, 7, 9, 11, 13 and 15 present the data for these tests. Of significance is the Most Probable Number (M.P.N.) of coliforms which range from 17 orgs/100ml on January 22, 1969 at Cushing Bridge to 1800+ orgs/100ml on nine of eleven samples taken at Stier's Ranch. The coliform group of bacteria indicates the amount of pollution by domestic waste.

The Standard Plate Count provides supporting information regarding the significance of the results from the Most Probable Number of Coliforms. A value of 1,000,000 counts/ml was observed on September 11, 1968 at Stier's Ranch.

CONCLUSIONS

The water quality in the Bow River has only been fair. Nutrient concentrations were excessively high again this year. Phenolic loadings were also unusually high during the 1968 - 1969 surveys. The Threshold Odor Number was quite acceptable during the survey period. However, it can be seen that the Oils and Greases concentrations in the Bow River were high at times.

It can be seen that strict control must be maintained in curbing the excessive phenolic and nutrient loadings to the Bow River.

W J Matheson

W.J. Matheson,
Water Pollution Control Engineer.

April 25, 1969.

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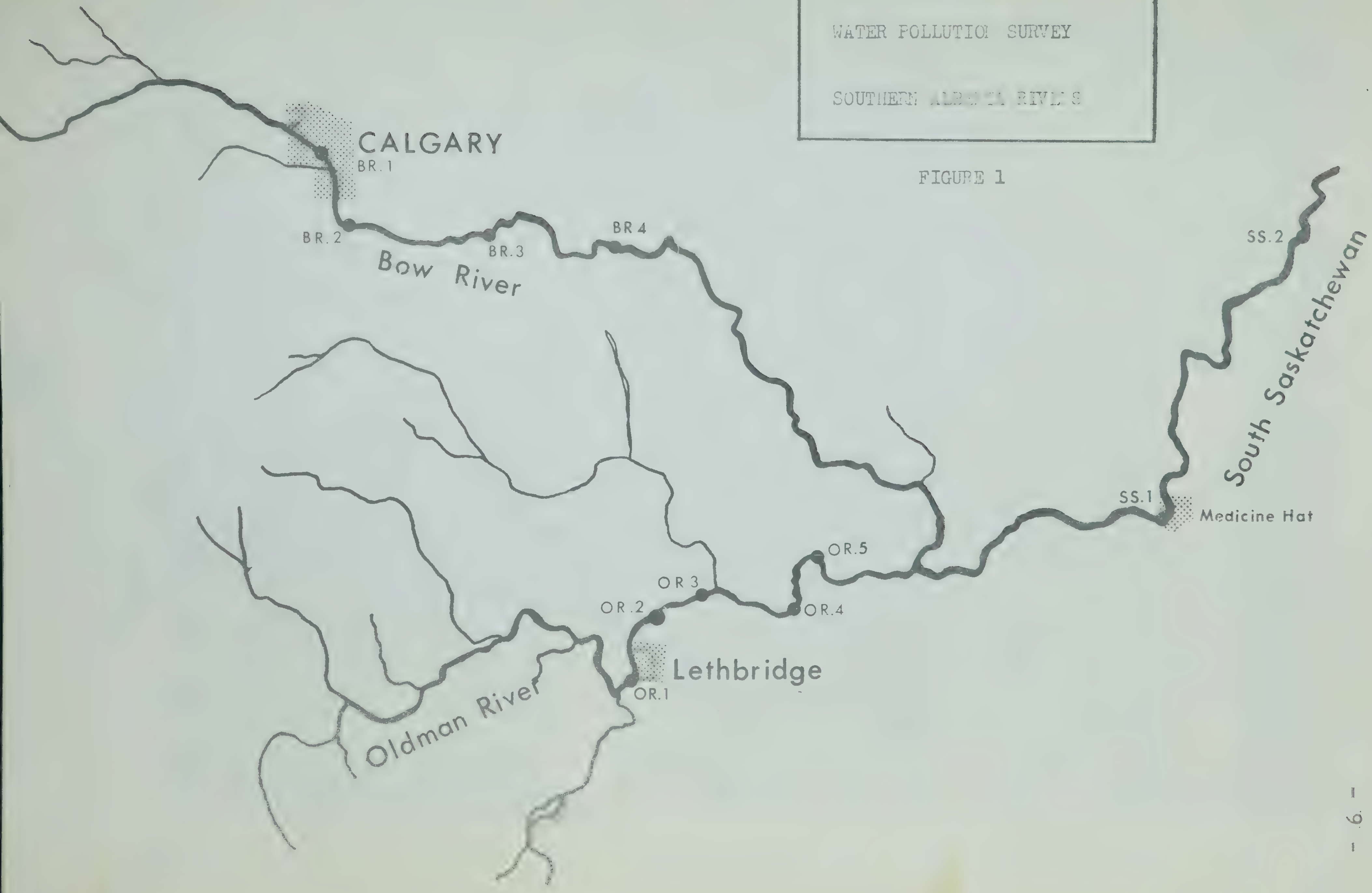
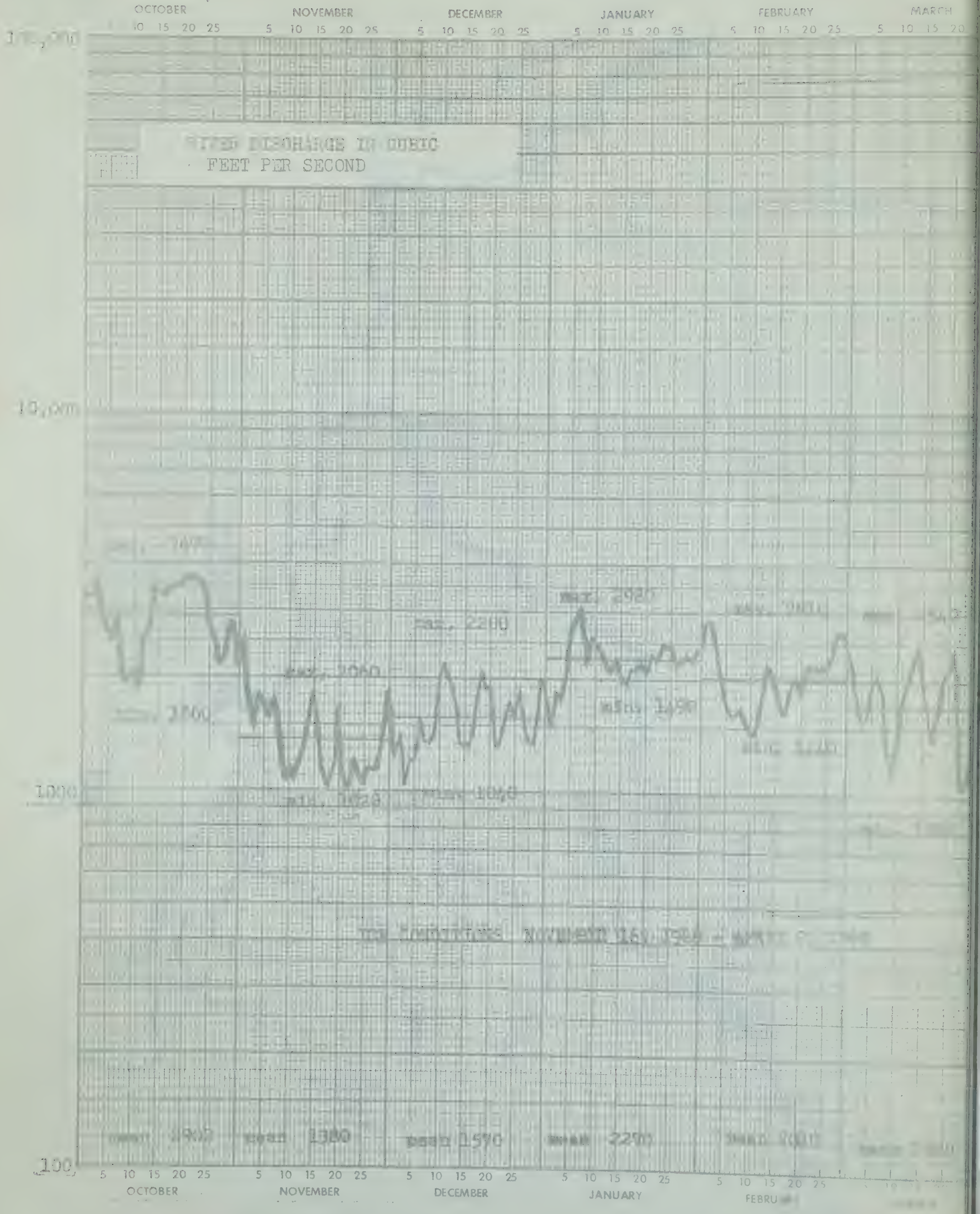
DEPT. OF PUBLIC HEALTH

WATER POLLUTION SURVEY

SOUTHERN ALBERTA RIVERS

FIGURE 1

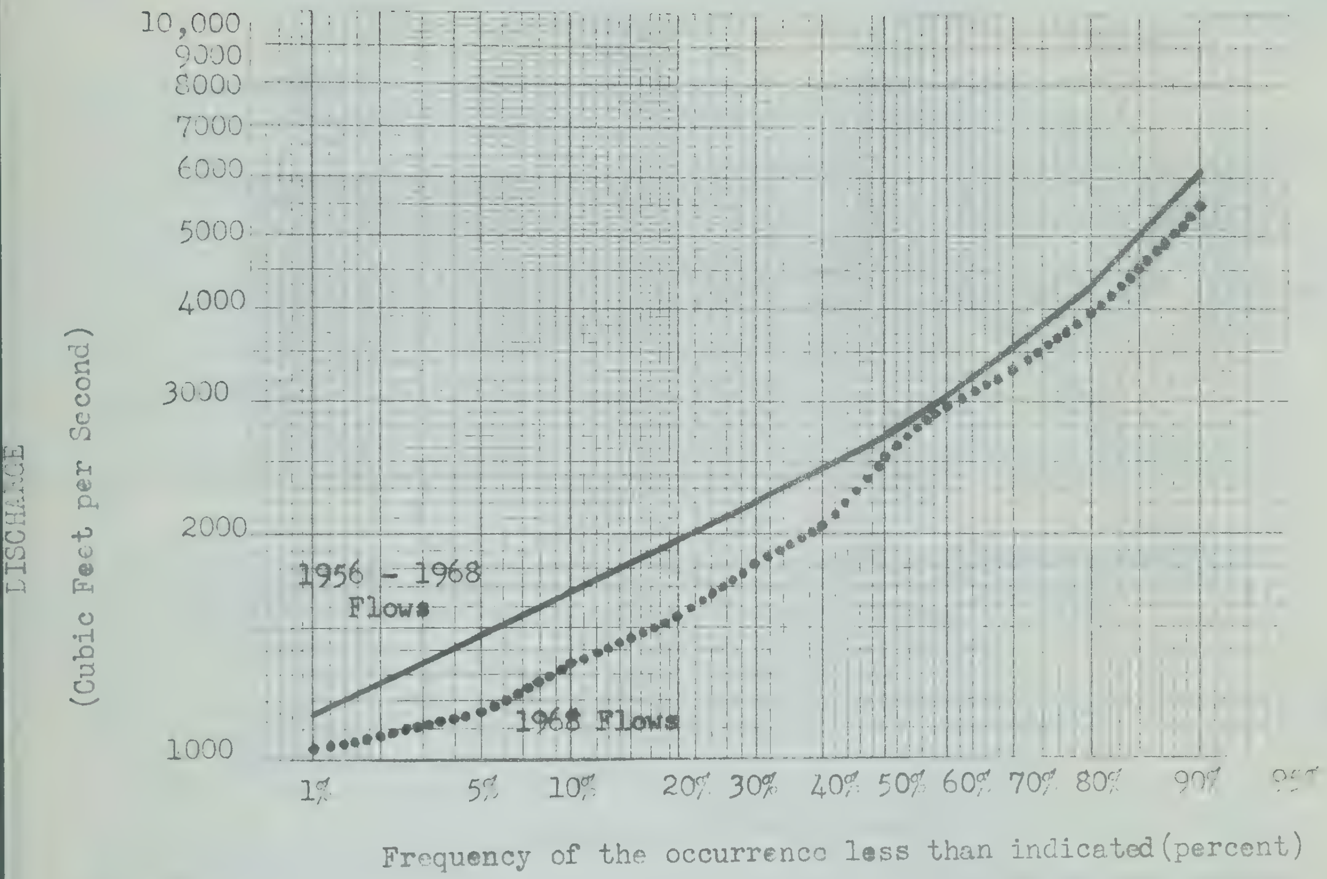




BOW RIVER AT CALGARY

STATION NO. [illegible]

FIGURE 2



STATISTICAL FLOW ANALYSIS FOR THE BOW RIVER AT CALGARY

12 years data

Maximum Flow is	16,100 cubic feet per second
Minimum Flow is	680 cubic feet per second

1968

Maximum Flow is	9070 cubic feet per second
Minimum Flow is	1020 cubic feet per second

FIGURE 3

BOW RIVER SAMPLING RESULTS

OCTOBER 21 - 23, 1968

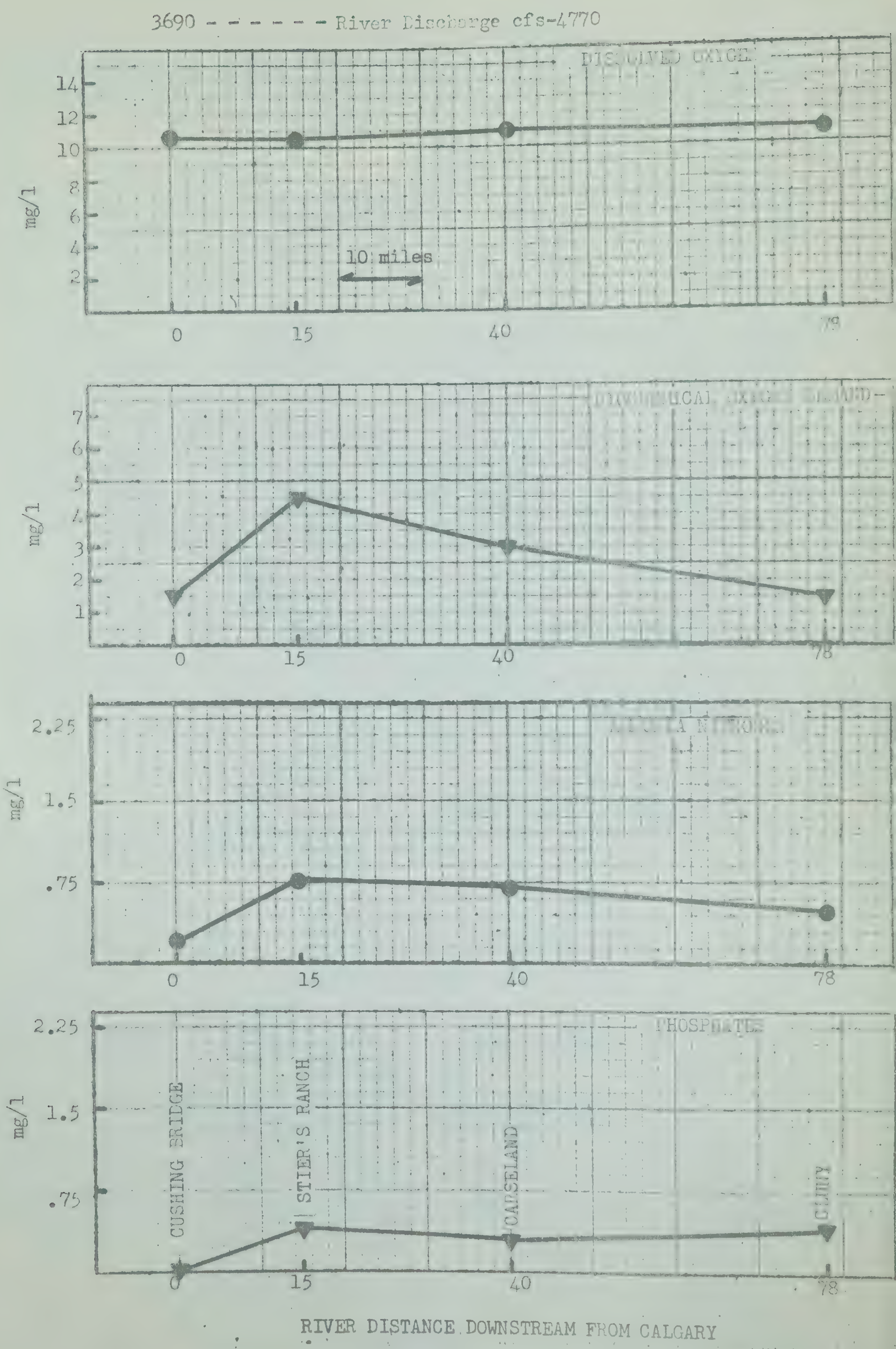


Figure 4

BOW RIVER SAMPLING RESULTS

OCTOBER 21 - 23, 1968

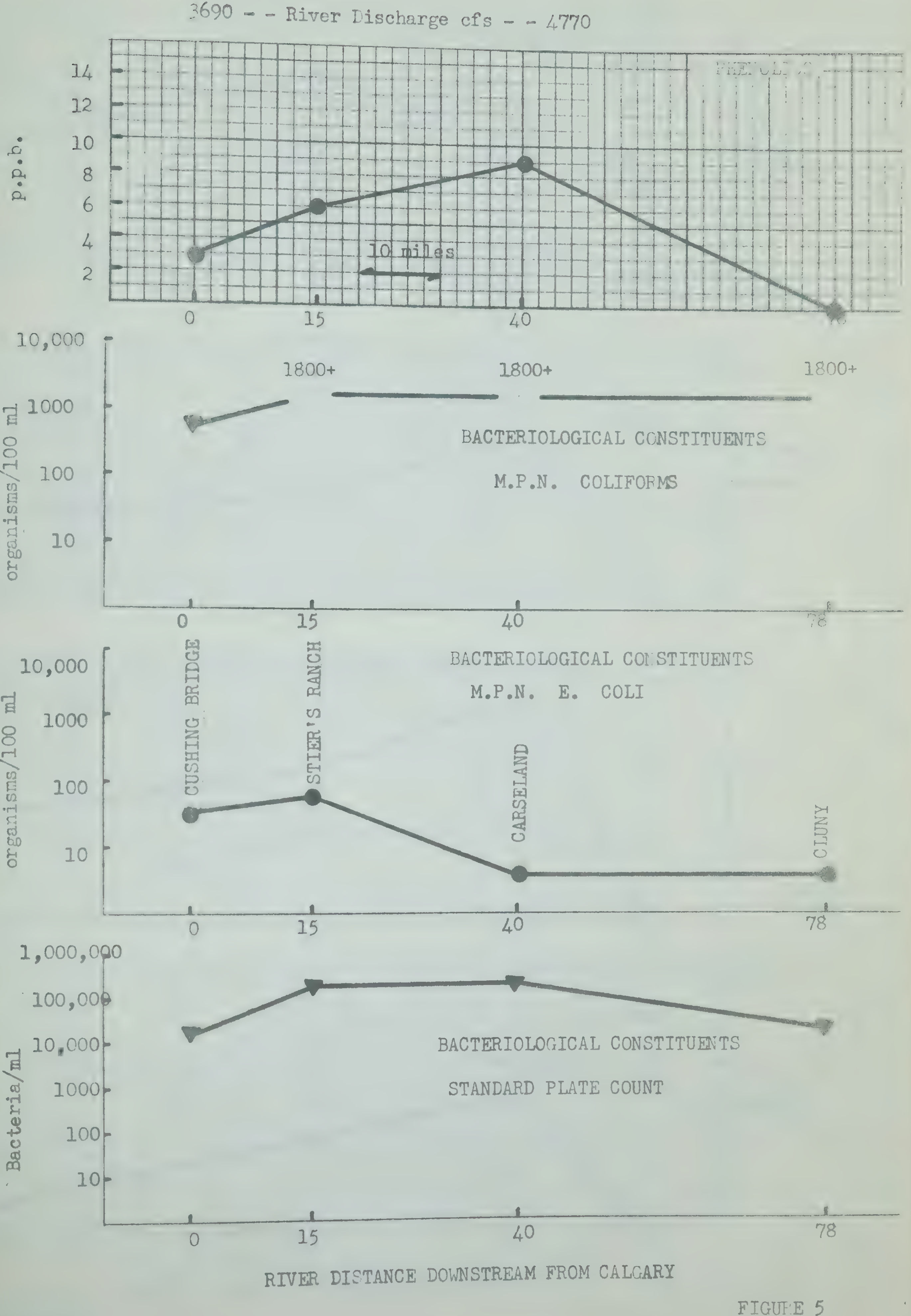
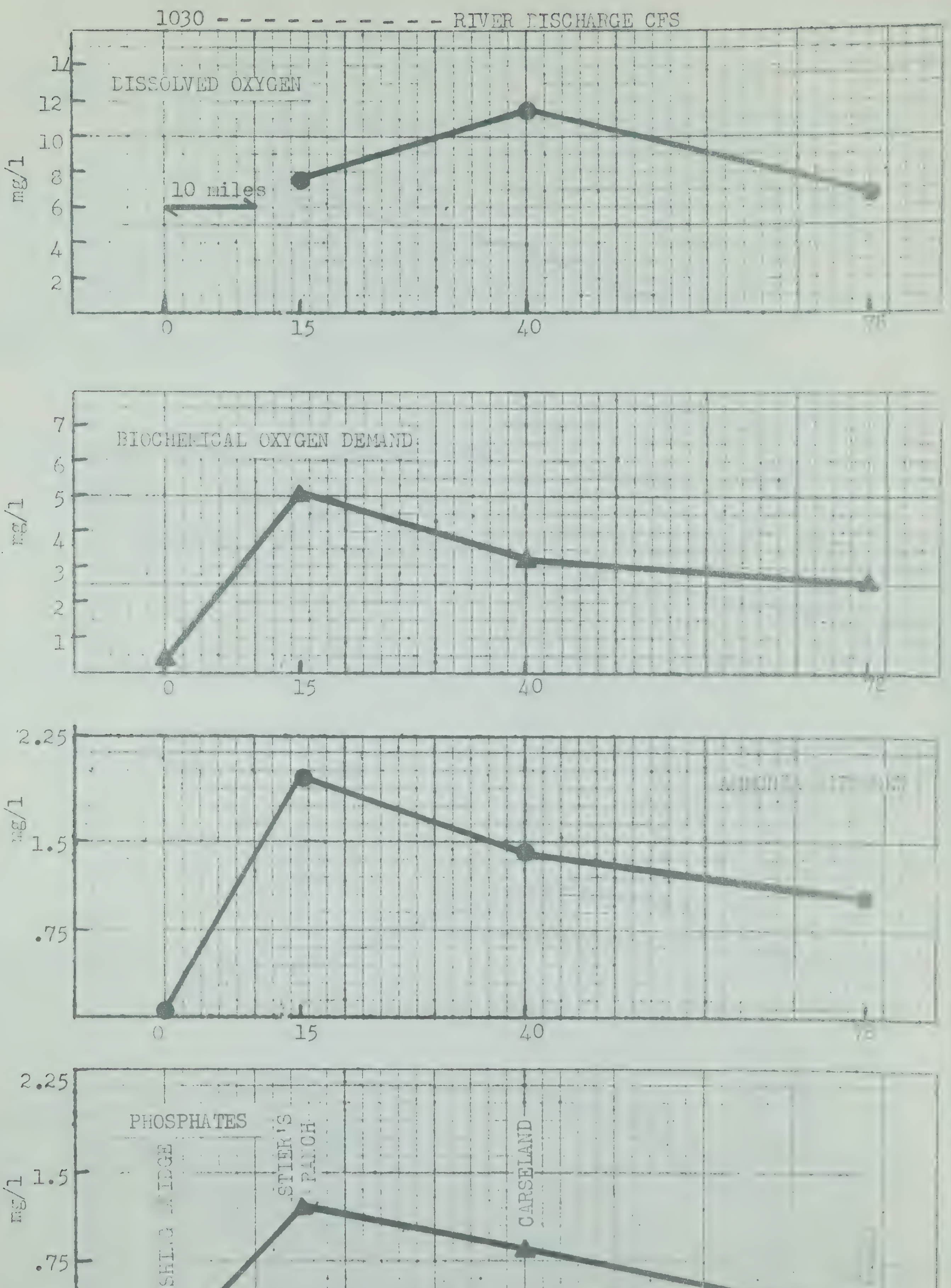


FIGURE 5



BOW RIVER SAMPLING RESULTS
Nov. 18 - 19, 1968

FIGURE 6

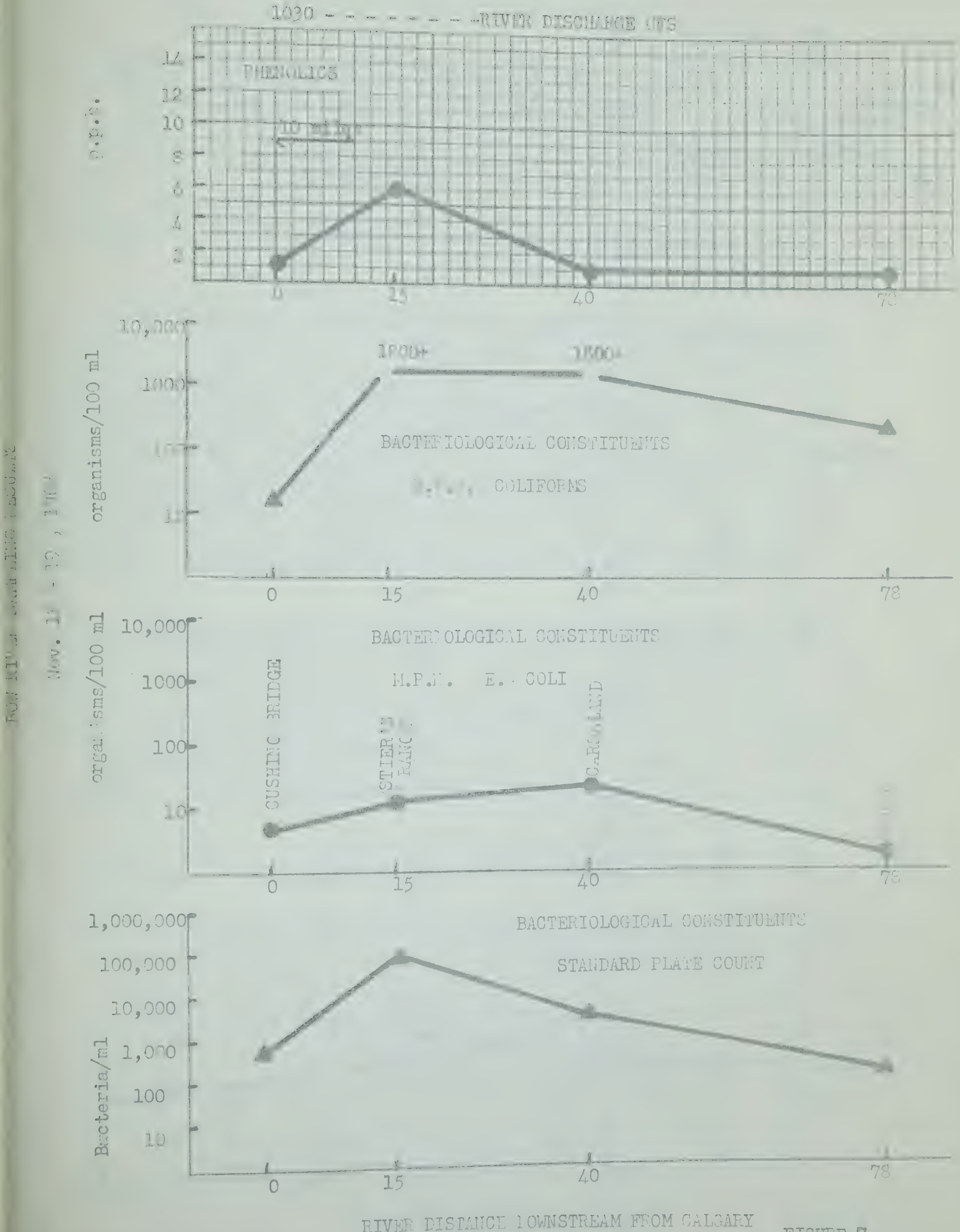

BOW RIVER SAMPLING PROGRAM
Nov. 1[illegible] - 19, 19[illegible]
1030 - - - - - - - - -RIVER DISCHARGE CFS
PHENOLICS
p.p.b.
10 miles
14
12
10
8
6
4
2
0
15
40
78
10,000
1000
100
10
organisms/100 ml
1800+
1800+
BACTERIOLOGICAL CONSTITUENTS
M.P.N. COLIFORMS
0
15
40
78
10,000
1000
100
10
organisms/100 ml
BACTERIOLOGICAL CONSTITUENTS
M.P.N. E. COLI
CUSHING BRIDGE
STIER'S RANCH
CARSELAND
0
15
40
78
1,000,000
100,000
10,000
1,000
100
10
Bacteria/ml
BACTERIOLOGICAL CONSTITUENTS
STANDARD PLATE COUNT
0
15
40
78
RIVER DISTANCE DOWNSTREAM FROM CALGARY

FIGURE 7

BOW RIVER SAMPLING RESULTS

Dec. 16 - 17, 1962

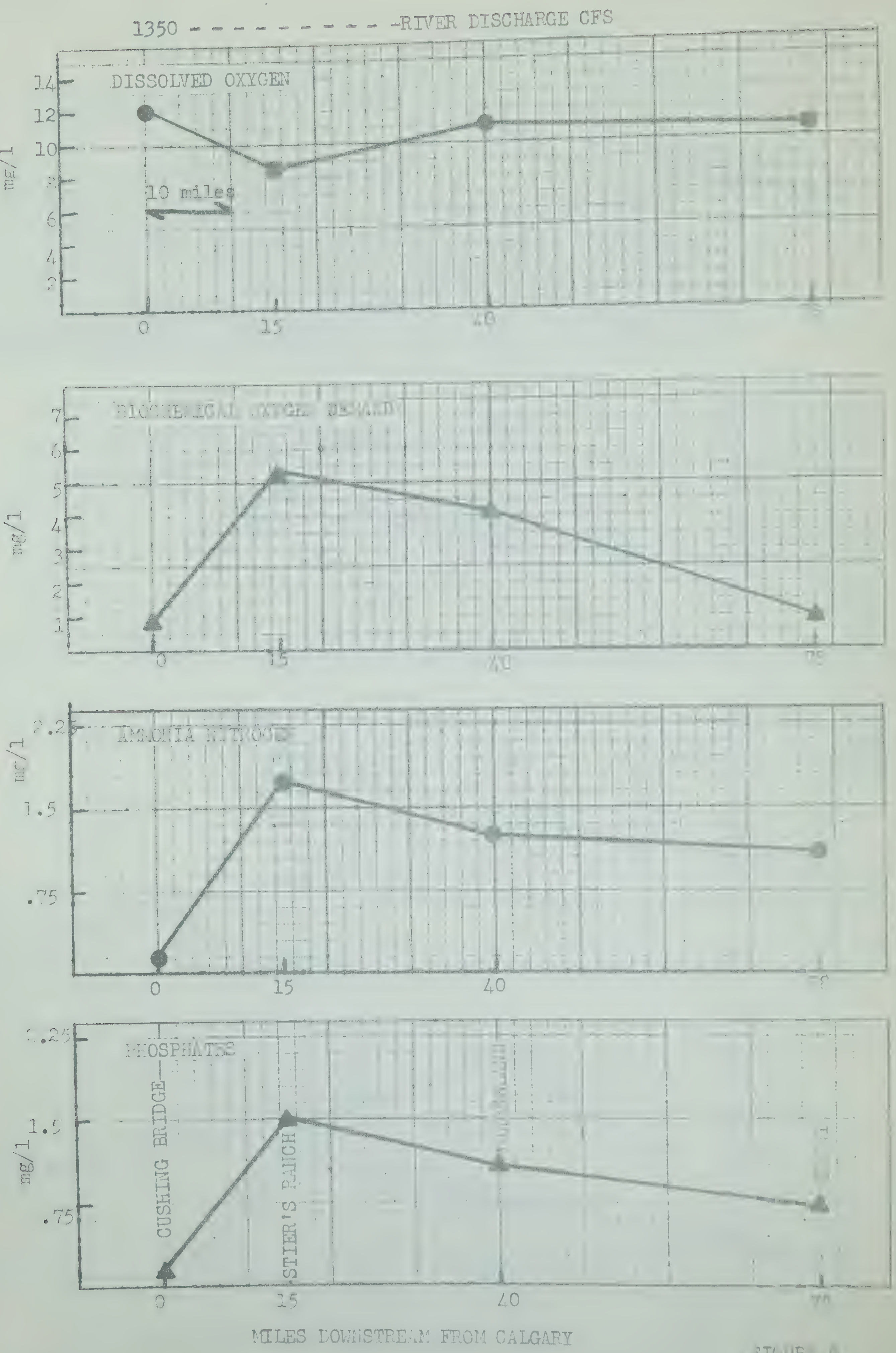
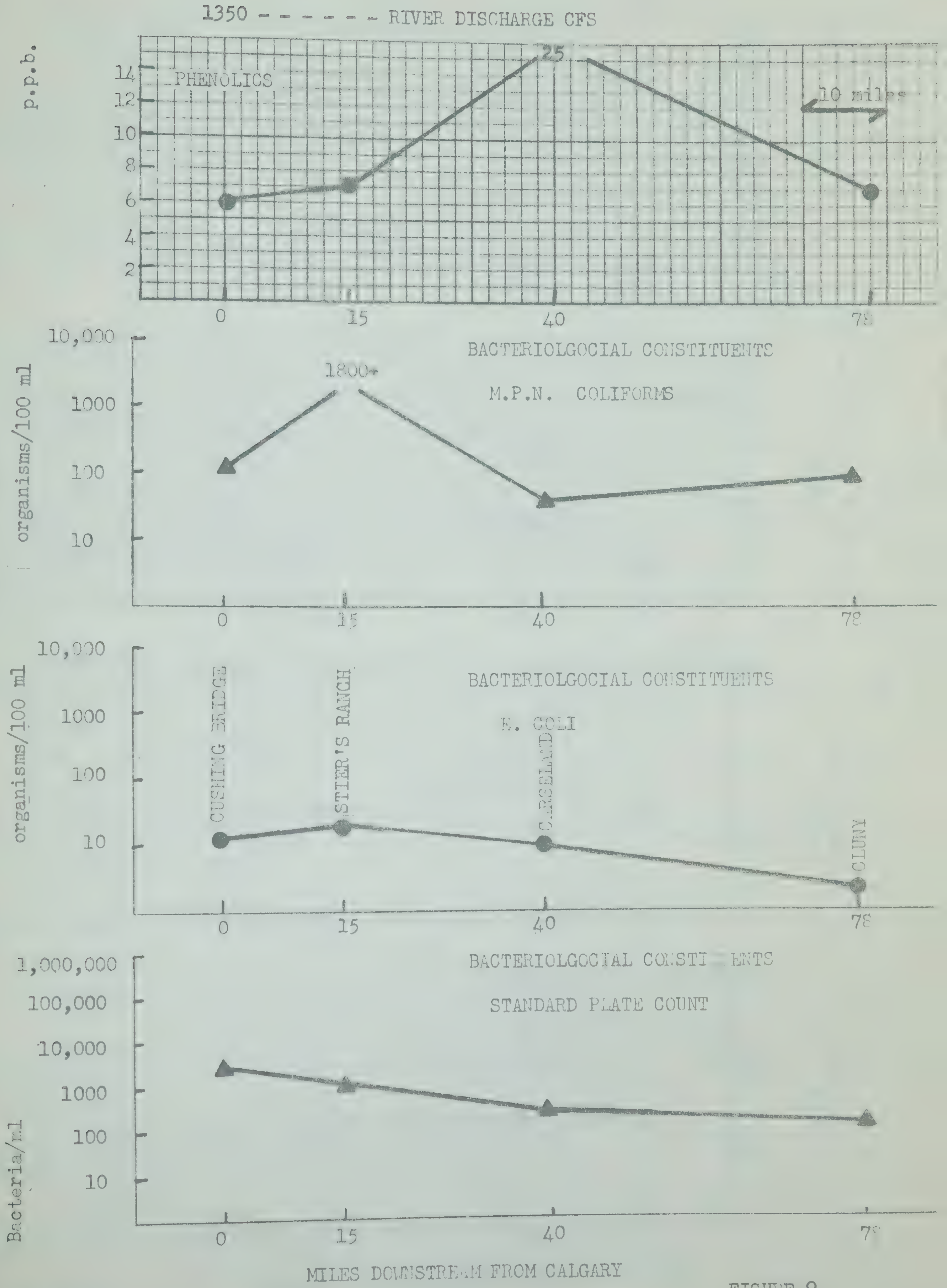


FIGURE 6



BOW RIVER SAMPLING RESULTS
Dec. 16 - 17, 1968

FIGURE 9

BOW RIVER SAMPLING RESULTS

Jan.20, 21, 22, 1969

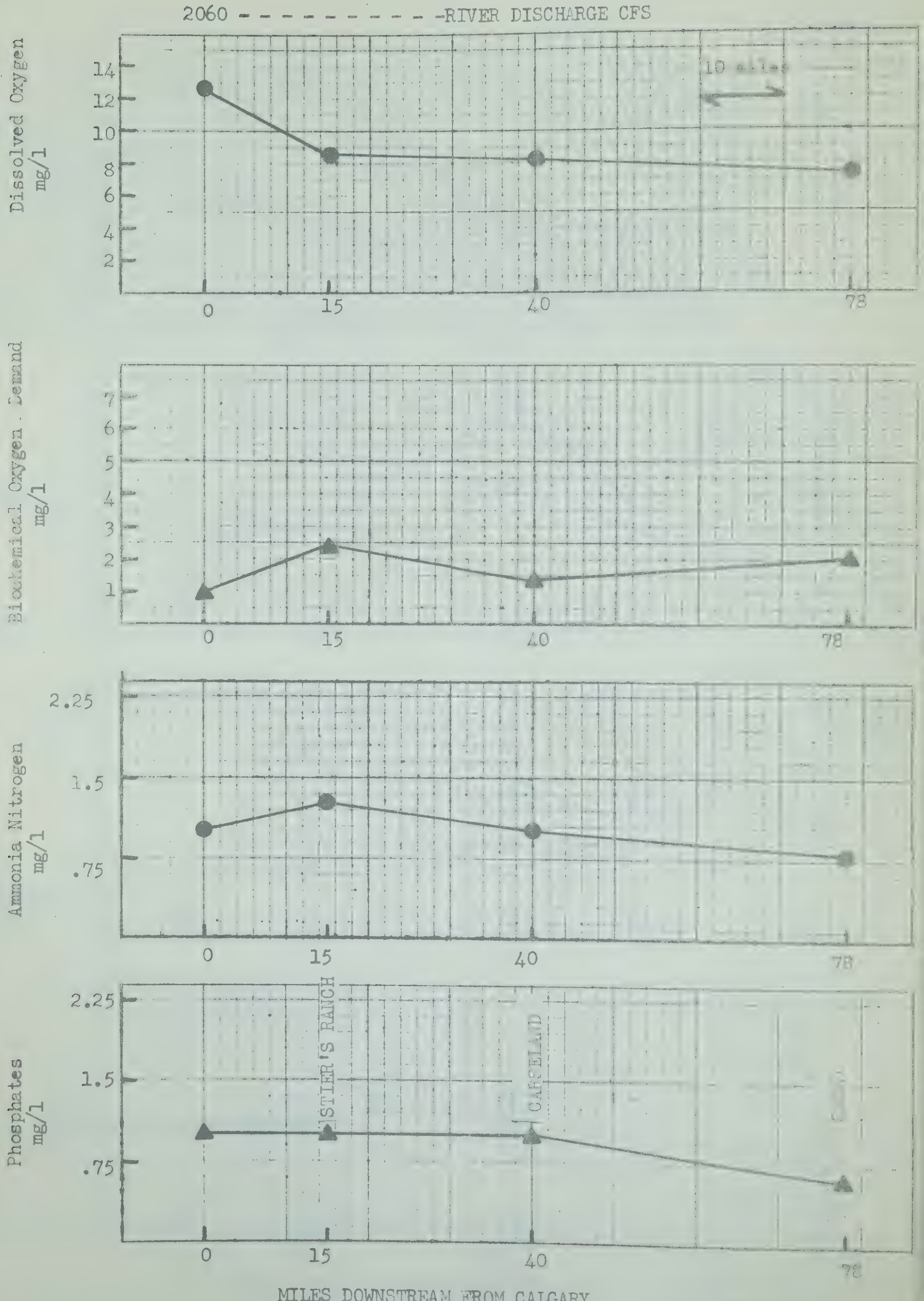


FIGURE 10

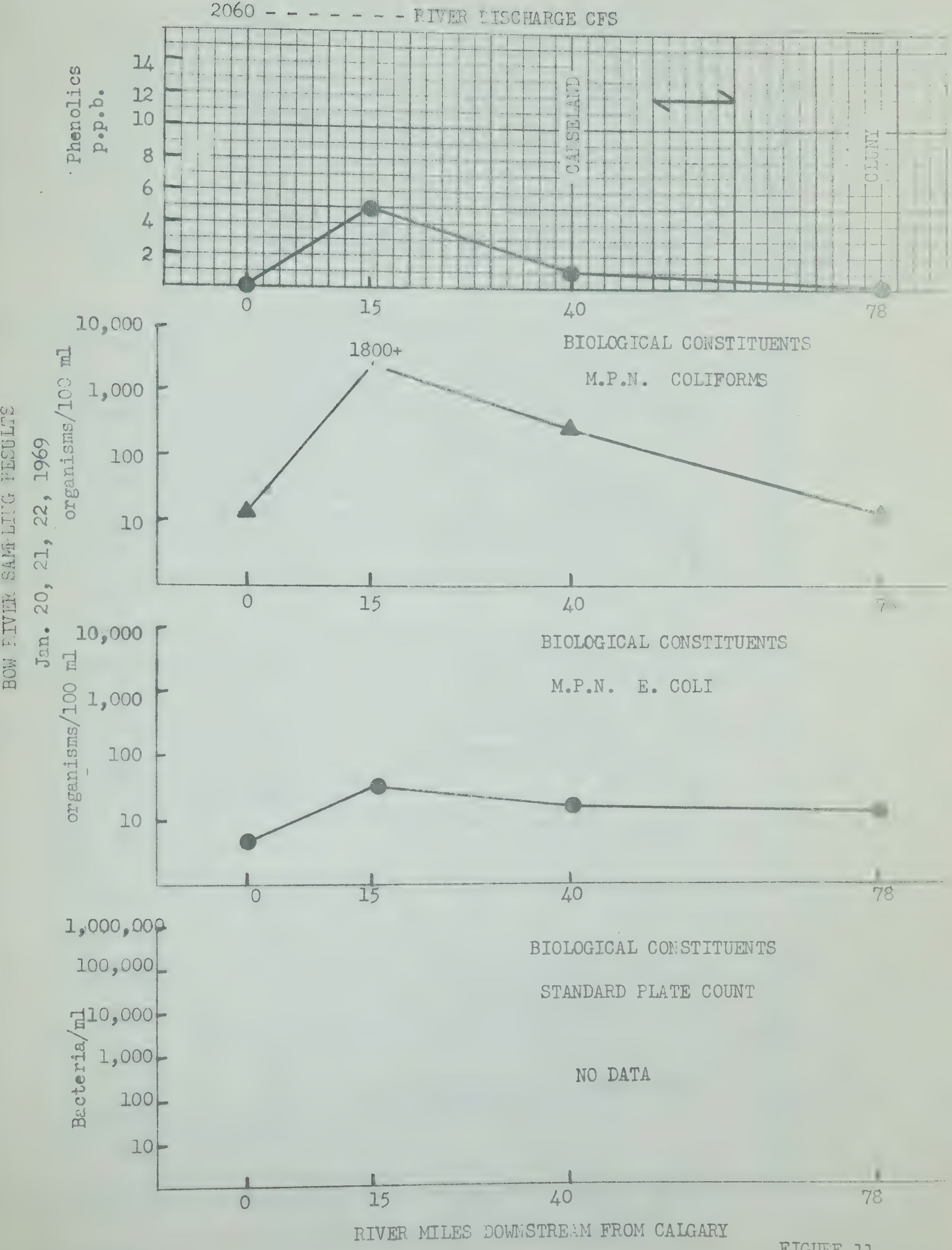

BOW RIVER SAMPLING RESULTS
Jan. 20, 21, 22, 1969
2060 - - - - - - - - RIVER DISCHARGE CFS
Phenolics p.p.b.
14
12
10
8
6
4
2
CARSELAND
CLUNY
0
15
40
78
10,000
1,000
100
10
organisms/100 ml
1800+
BIOLOGICAL CONSTITUENTS
M.P.N. COLIFORMS
BIOLOGICAL CONSTITUENTS
M.P.N. E. COLI
1,000,000
100,000
Bacteria/ml
BIOLOGICAL CONSTITUENTS
STANDARD PLATE COUNT
NO DATA
RIVER MILES DOWNSTREAM FROM CALGARY

FIGURE 11

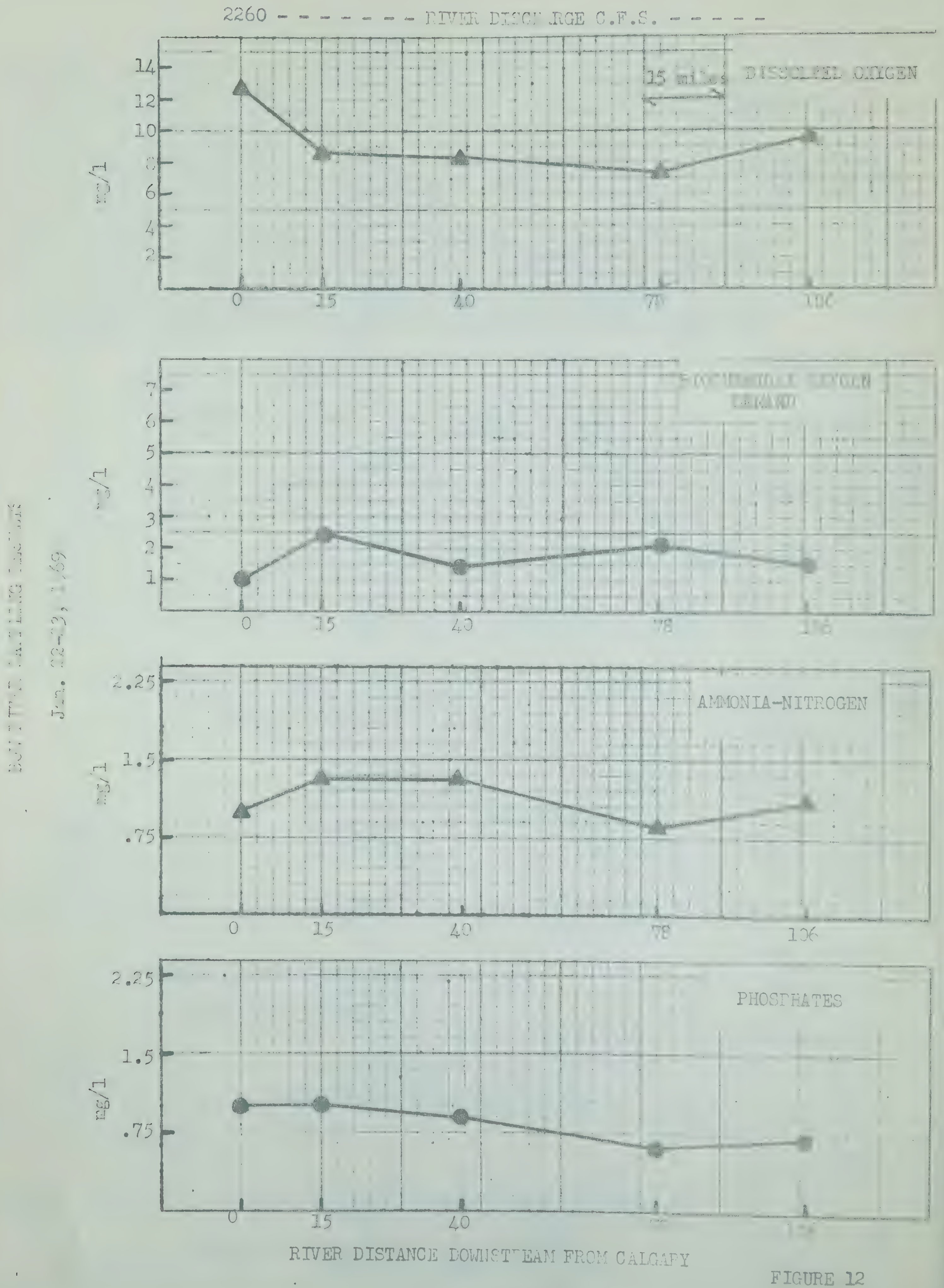

2260 - - - - - - - - RIVER DISCHARGE C.F.S. - - - - - -
15 miles
DISSOLVED OXYGEN
mg/1
14
12
10
8
6
4
2
0
15
40
78
106
BIOCHEMICAL OXYGEN DEMAND
mg/1
7
6
5
4
3
2
1
AMMONIA-NITROGEN
mg/1
2.25
1.5
.75
PHOSPHATES
Jan. 22-23, 1969
RIVER DISTANCE DOWNSTREAM FROM CALGARY

FIGURE 12

BOW RIVER [illegible] RESULTS

Jan. 22-23, 1969

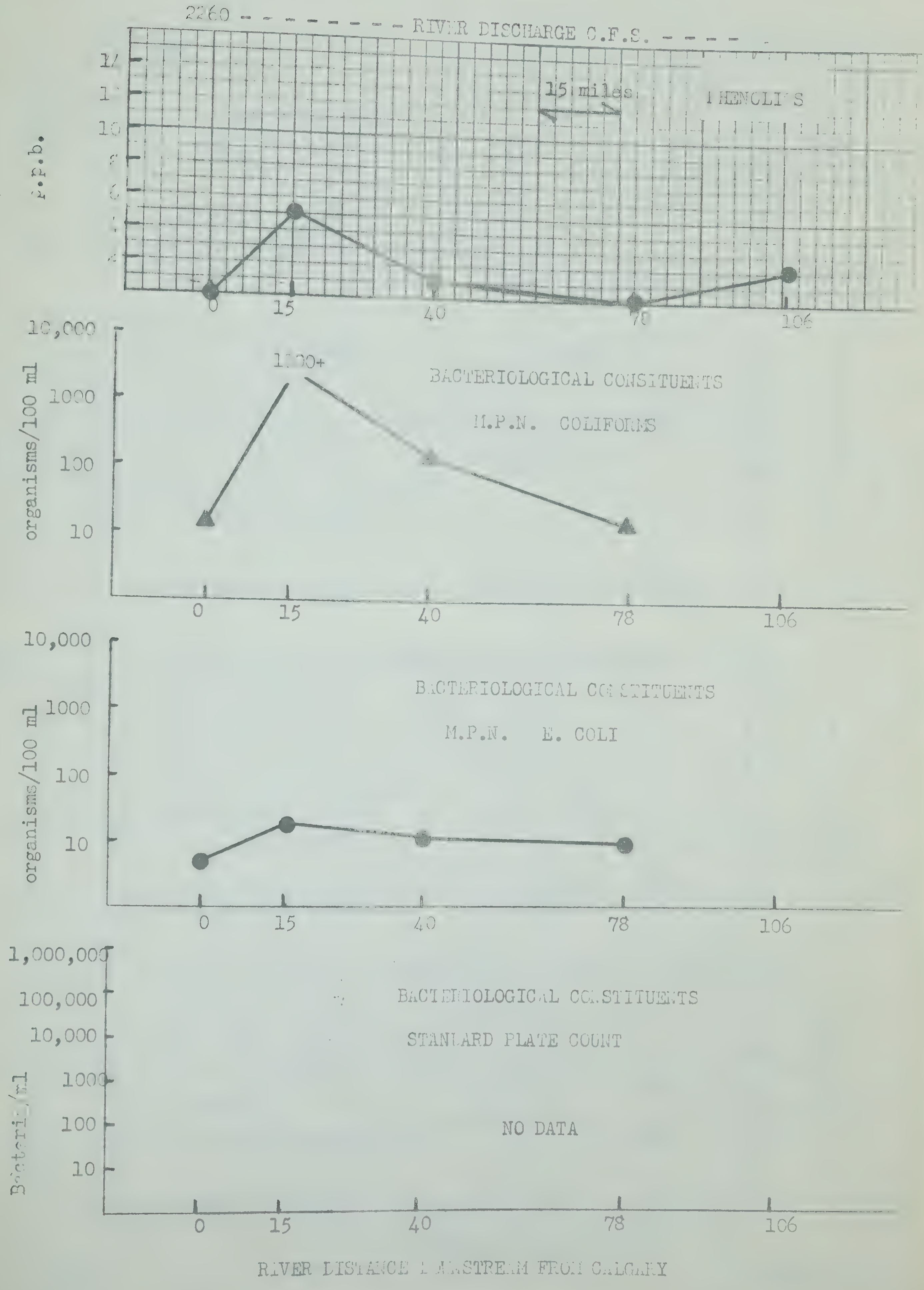


FIGURE 13

BOW RIVER SAMPLING RESULTS

Feb. 17, 18, 19, 1969

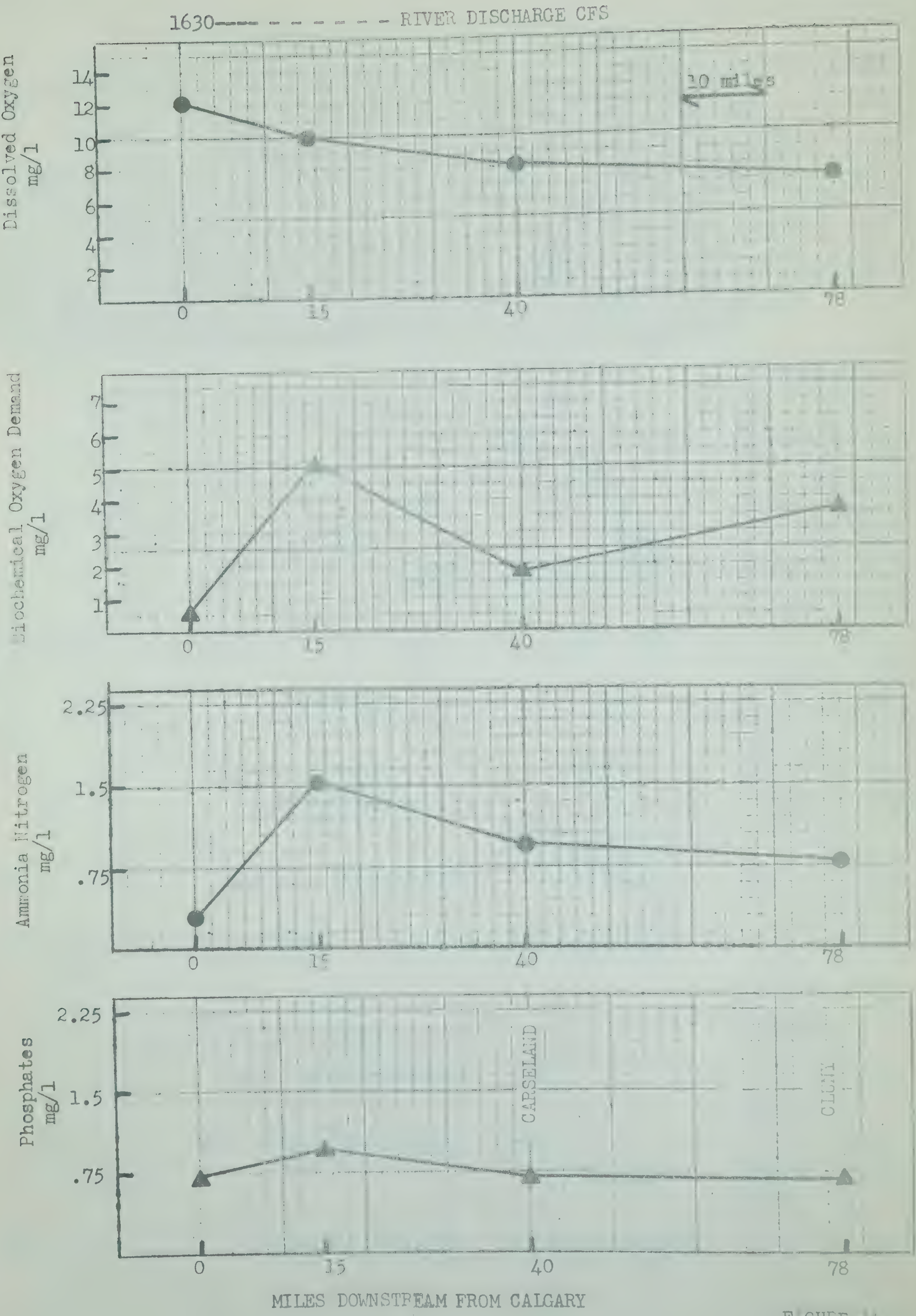
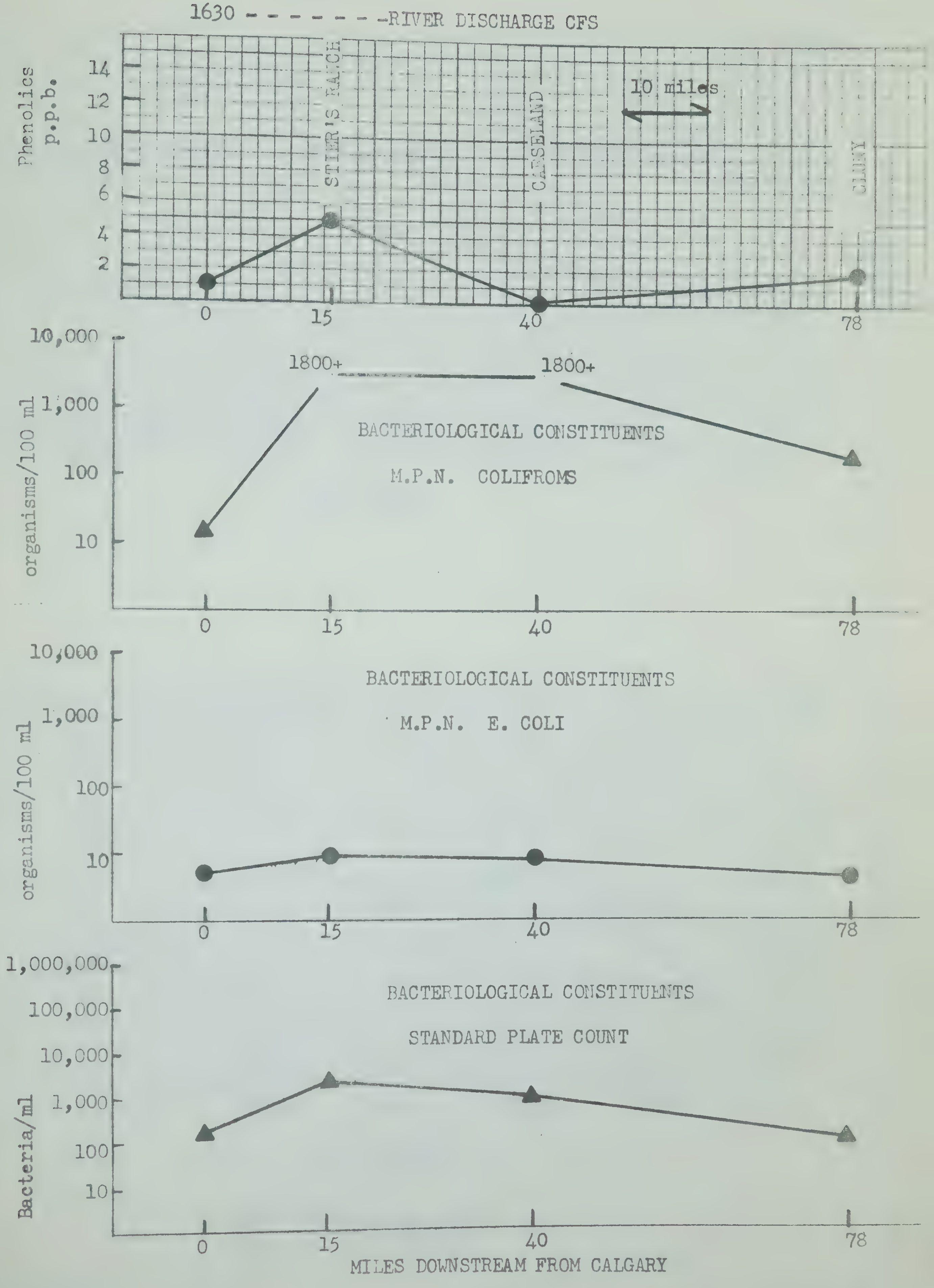


FIGURE 14



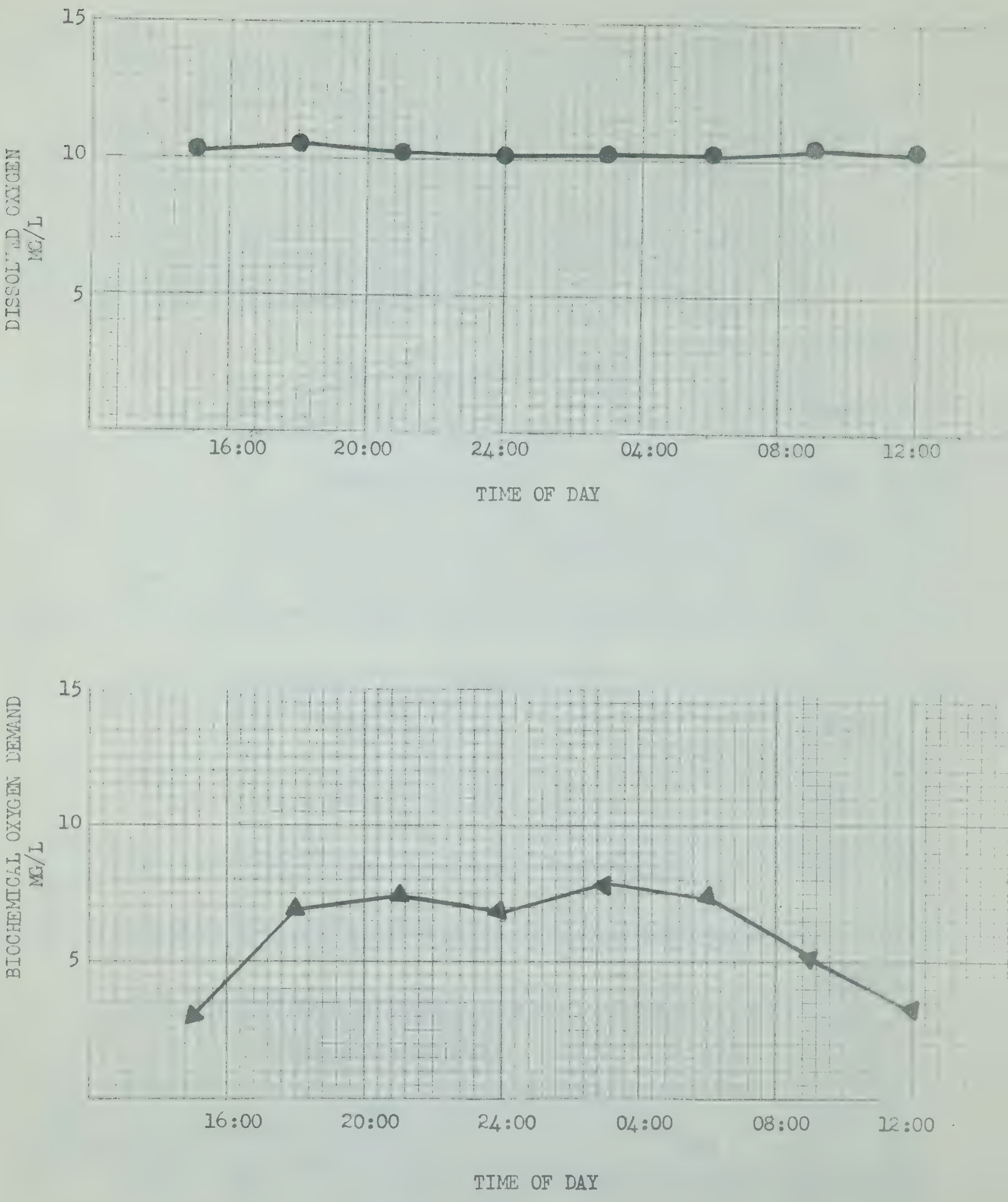
BOW RIVER SAMPLING RESULTS

Feb. 17, 18, 19, 1969

FIGURE 15

BOW RIVER COMPOSITE RESULTS

STIER'S RANCH

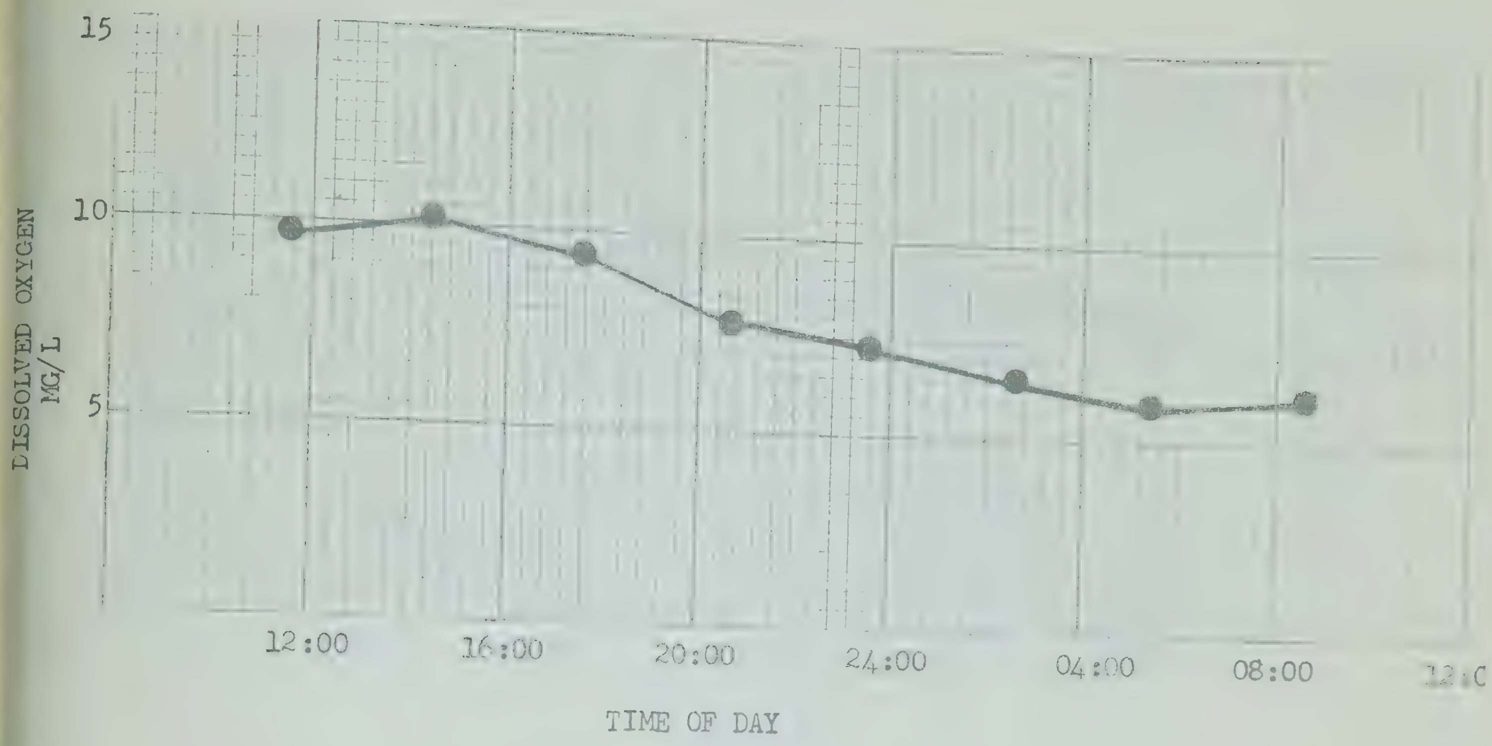


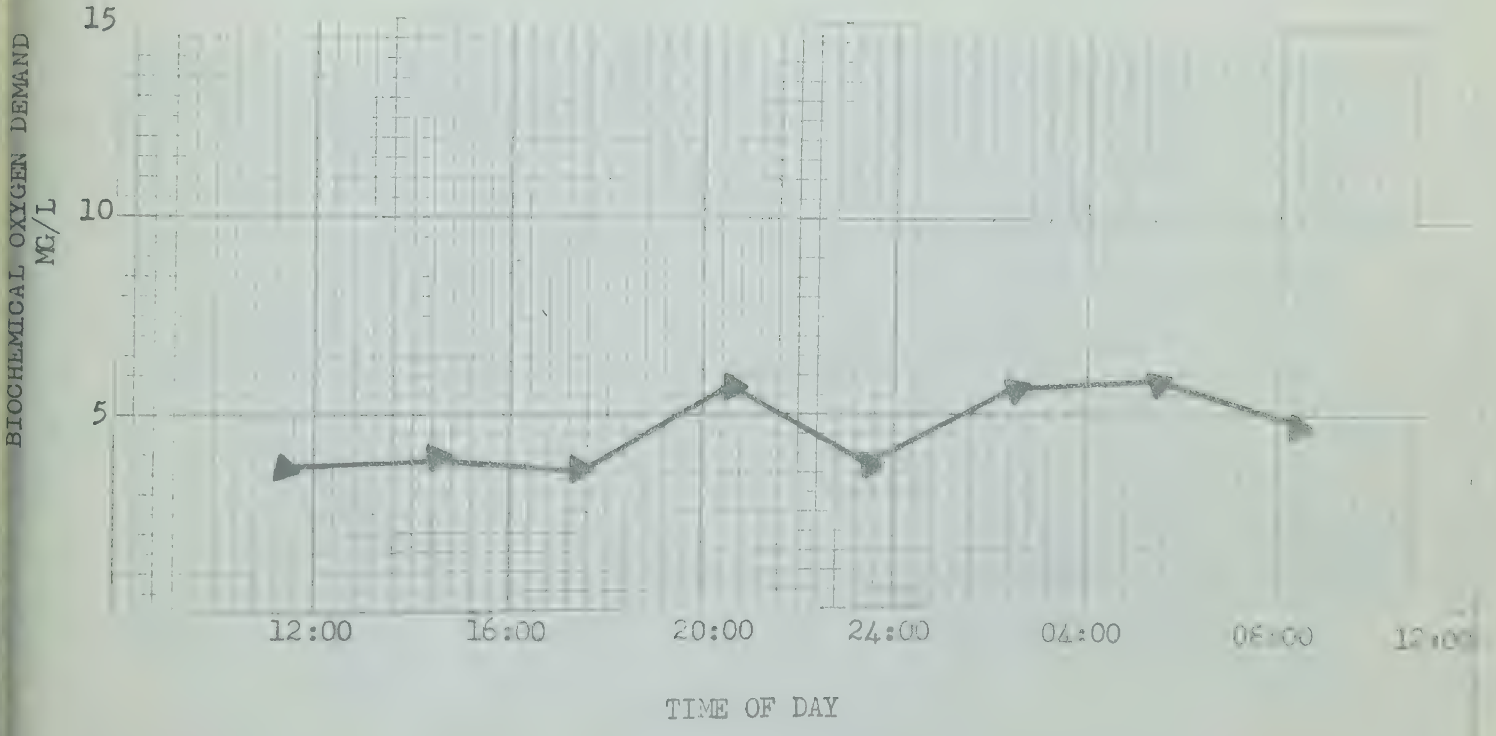
OCTOBER 21 - 22, 1968

FIGURE 16

BOW RIVER COMPOSITE RESULTS

STIER'S RANCH



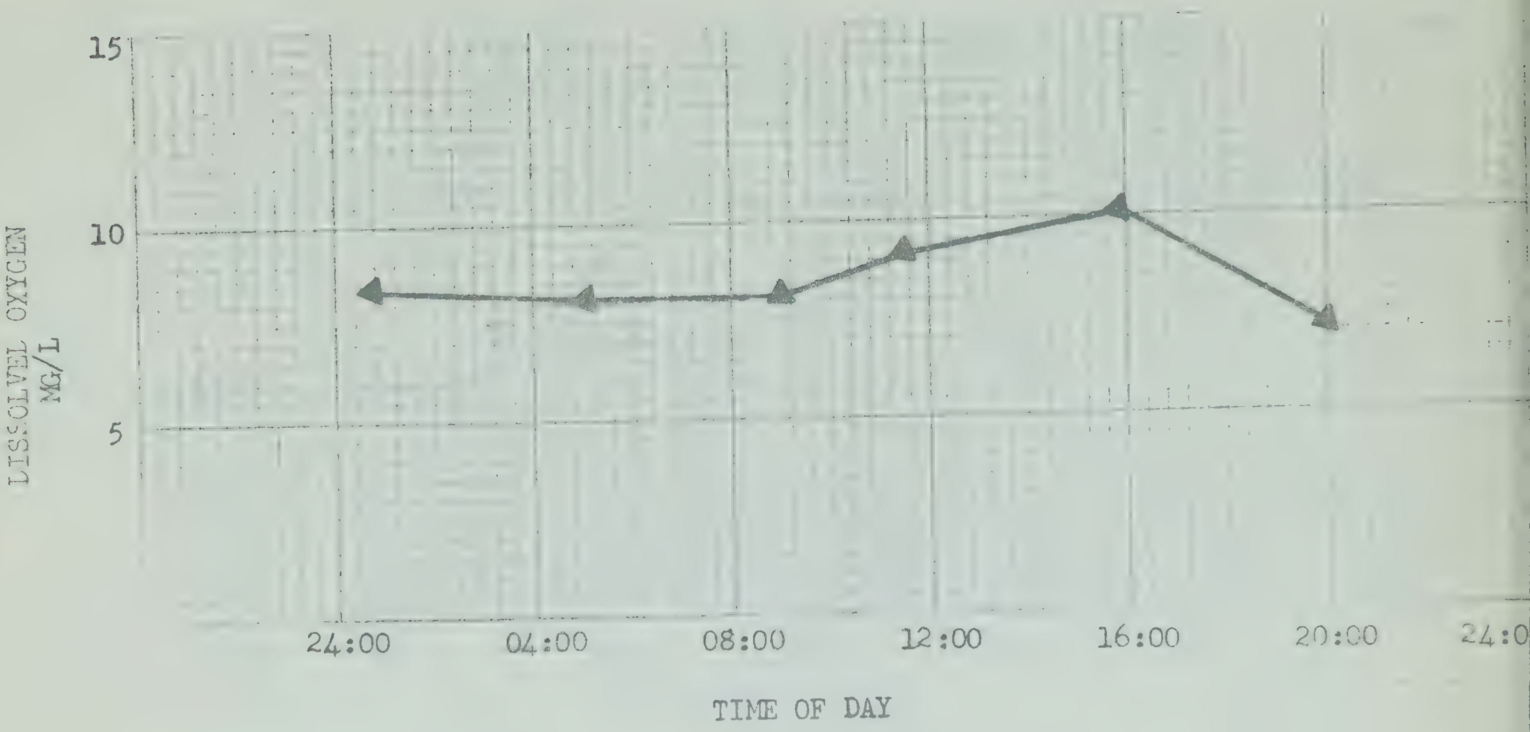


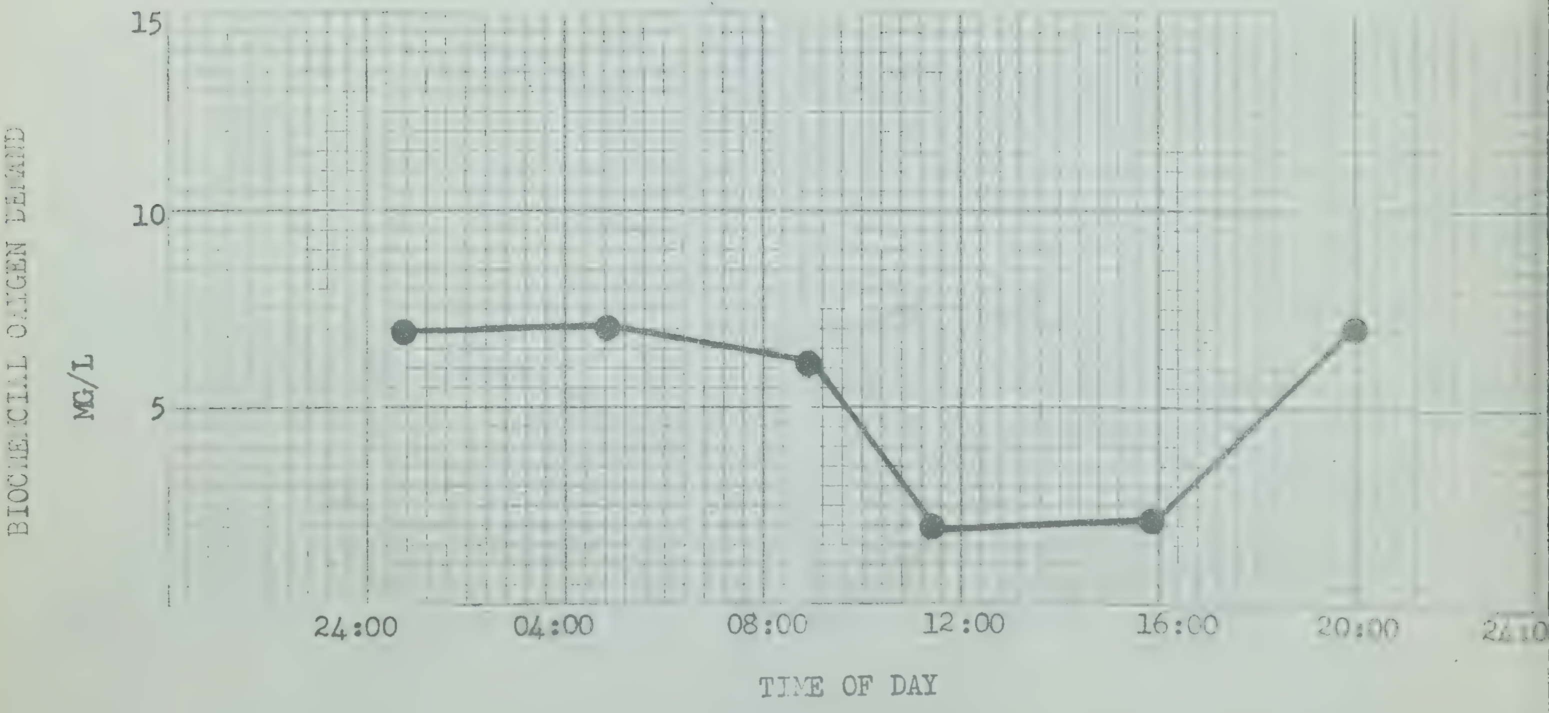
NOVEMBER 18 - 19 , 1968

FIGURE 17

BOW RIVER COMPOSITE RESULTS

STIER'S RANCH



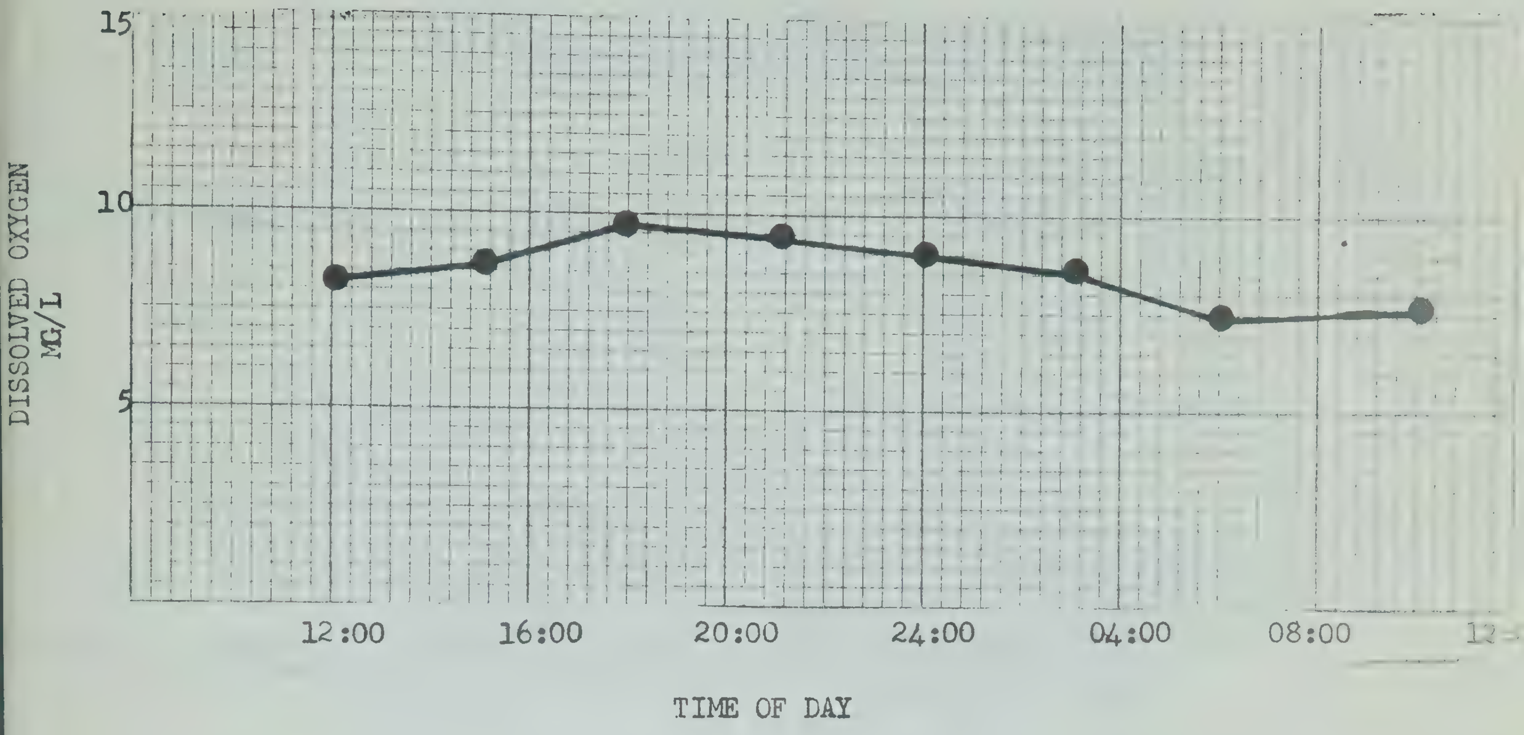


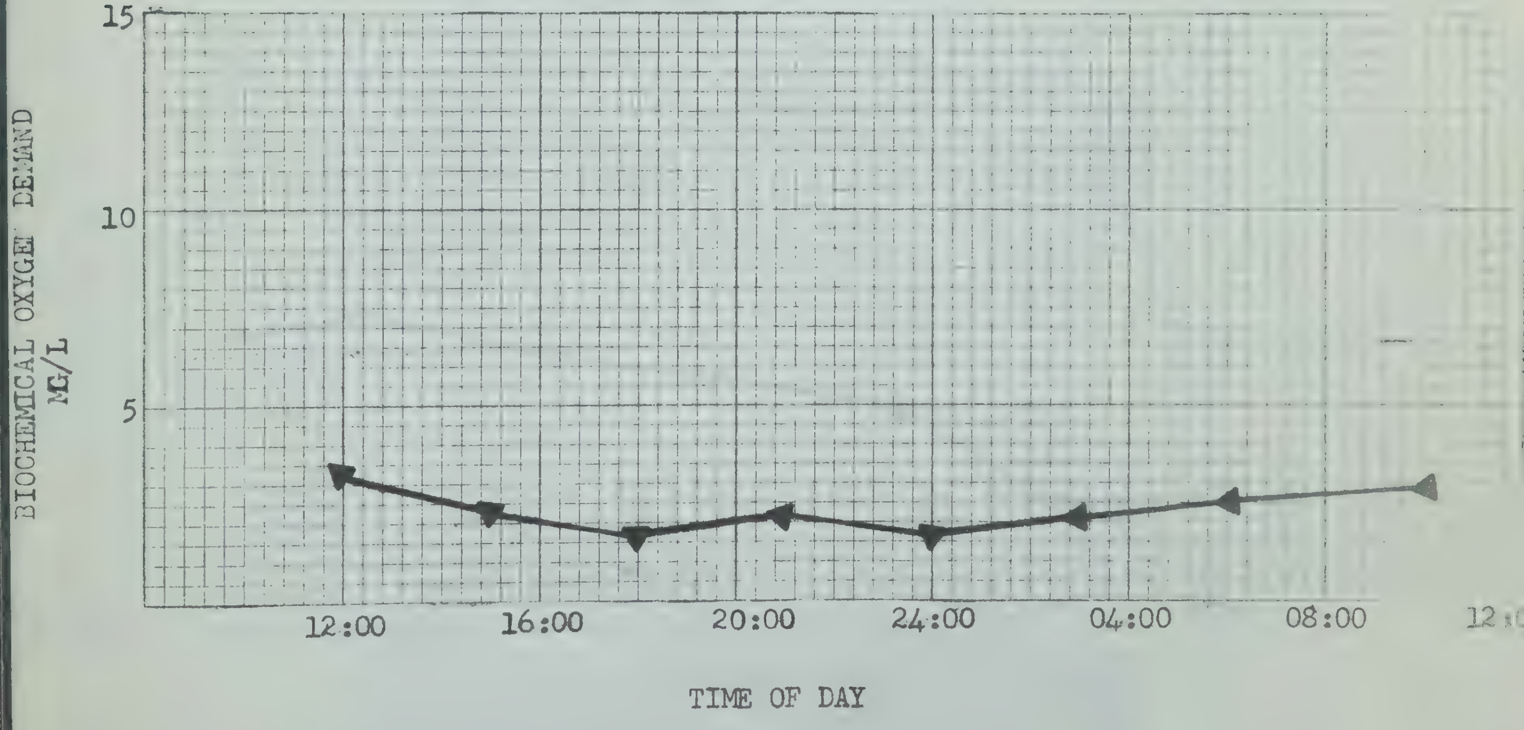
DECEMBER 17, 1968

FIGURE 18

BOW RIVER COMPOSITE RESULTS

STIER'S RANCH



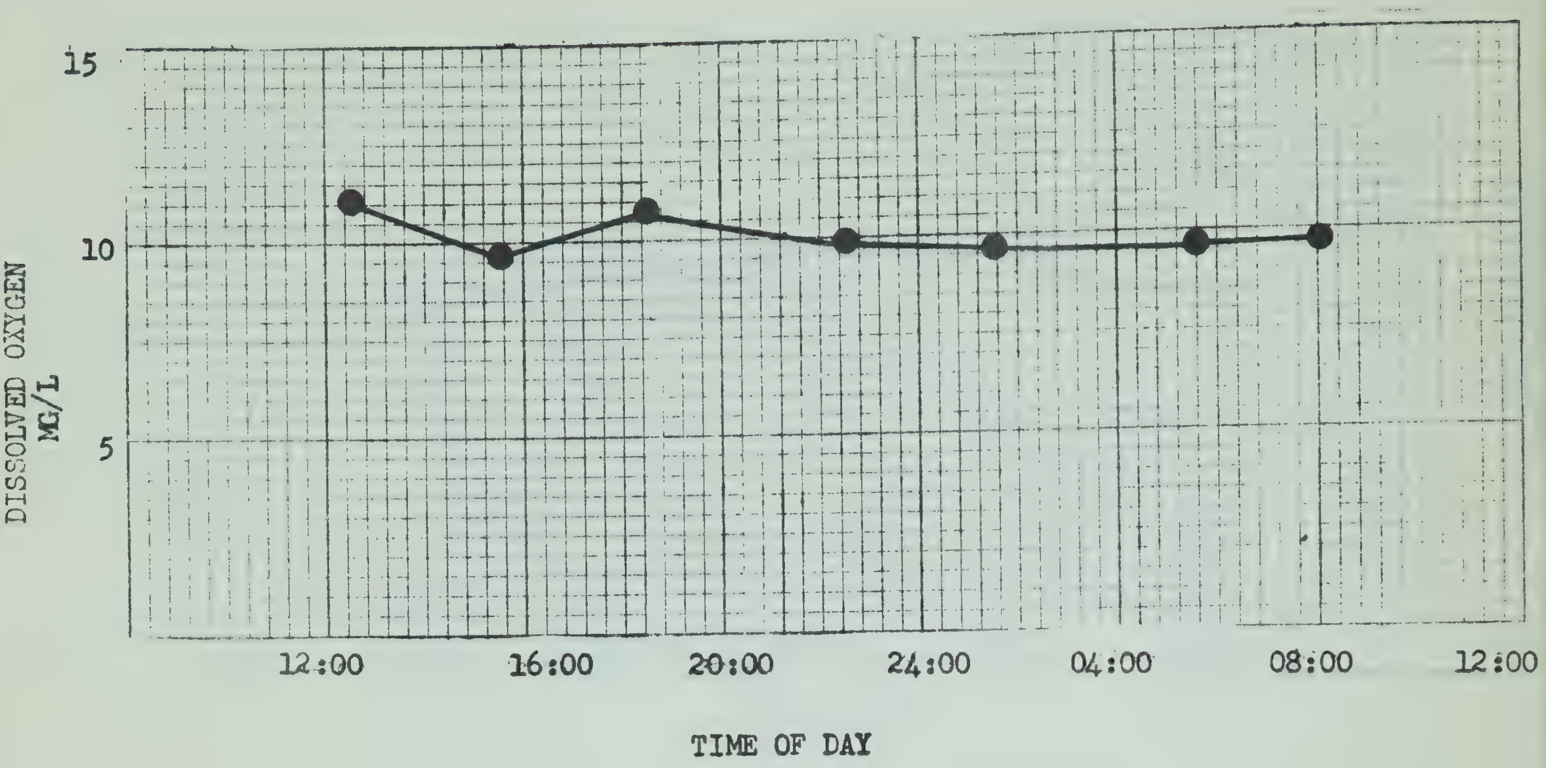


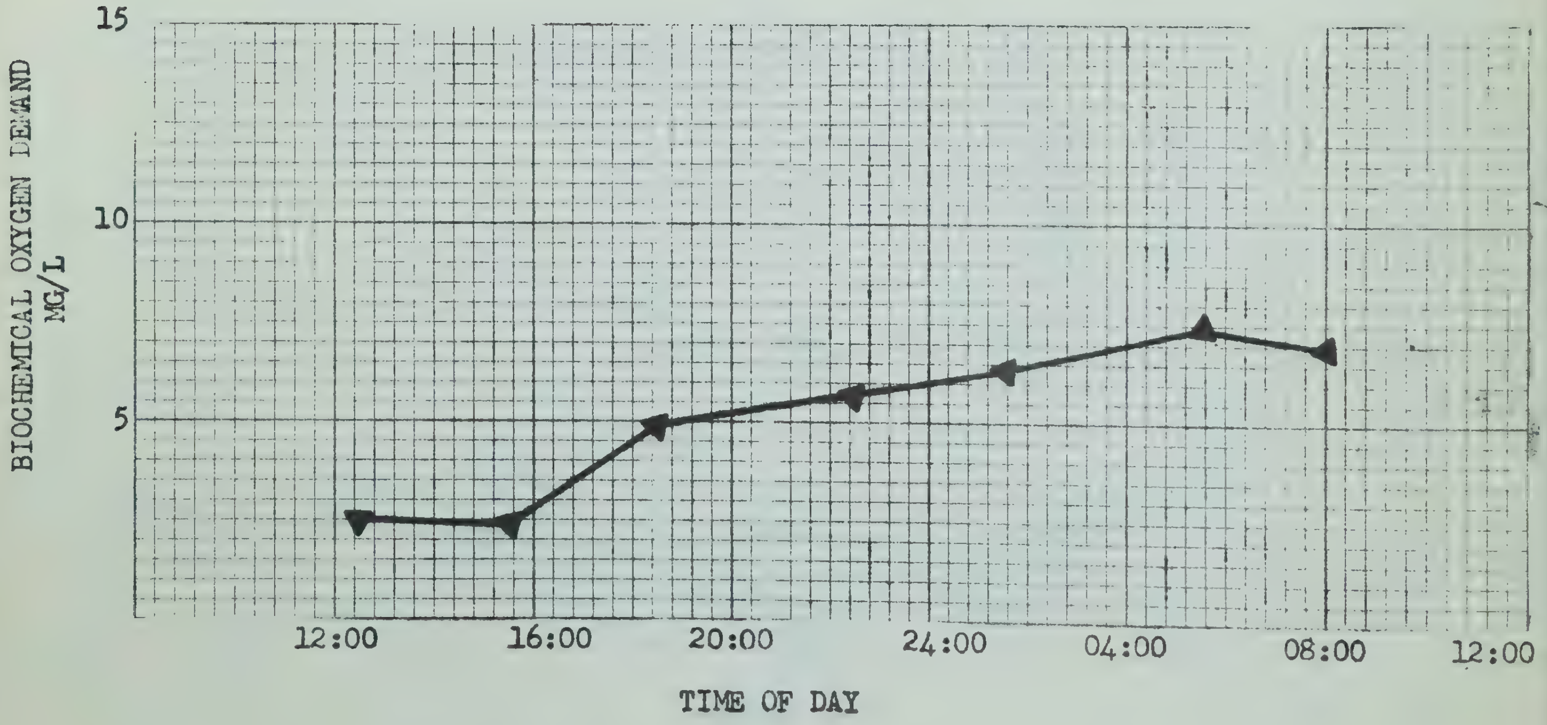
JANUARY 20 - 21, 1969

FIGURE 19

BOW RIVER COMPOSITE RESULTS

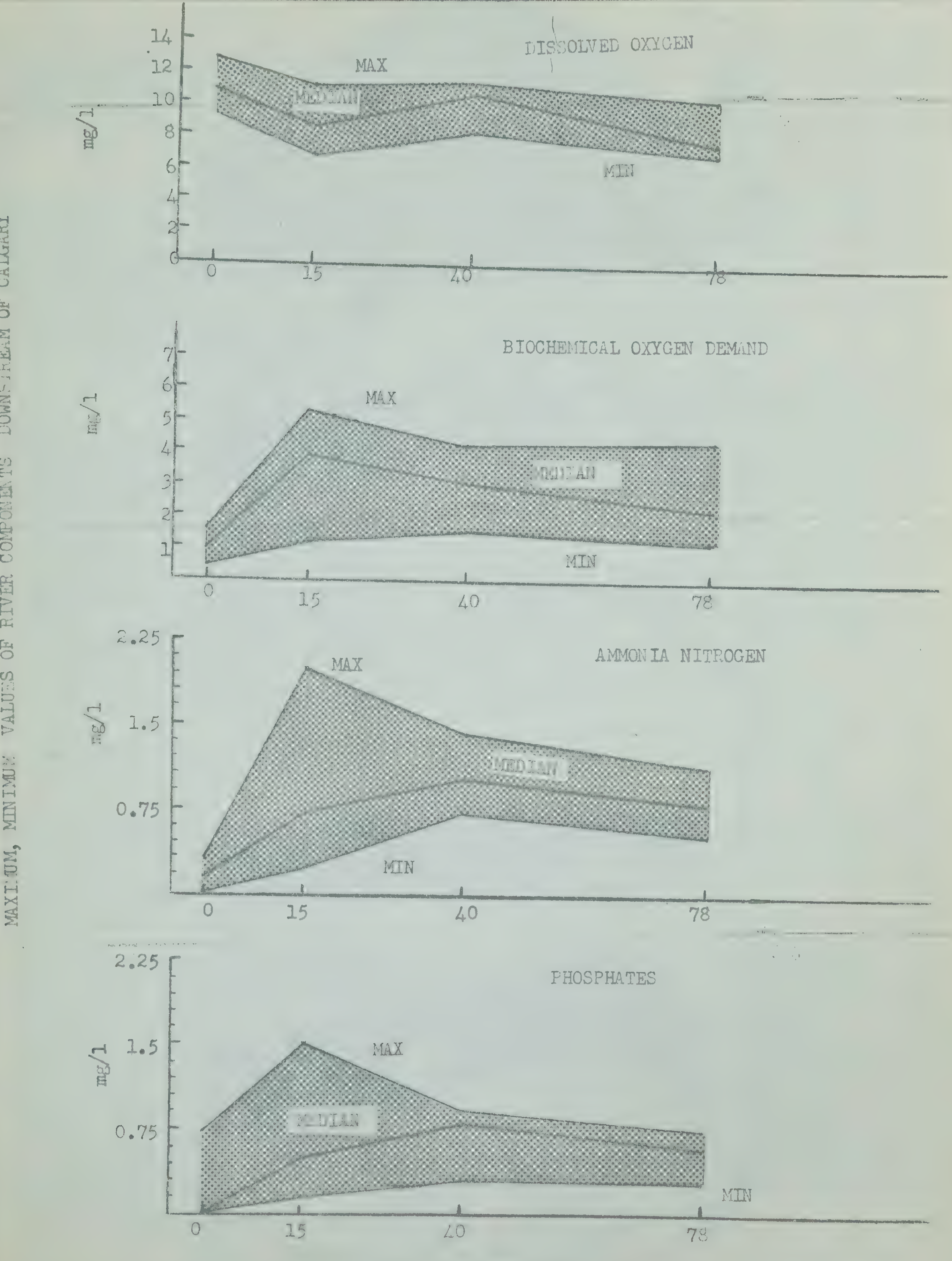
STIER'S RANCH





FEBRUARY 17 - 18, 1969

FIGURE 20



RIVER DISTANCE DOWNSTREAM FROM CALGARY FIGURE 21

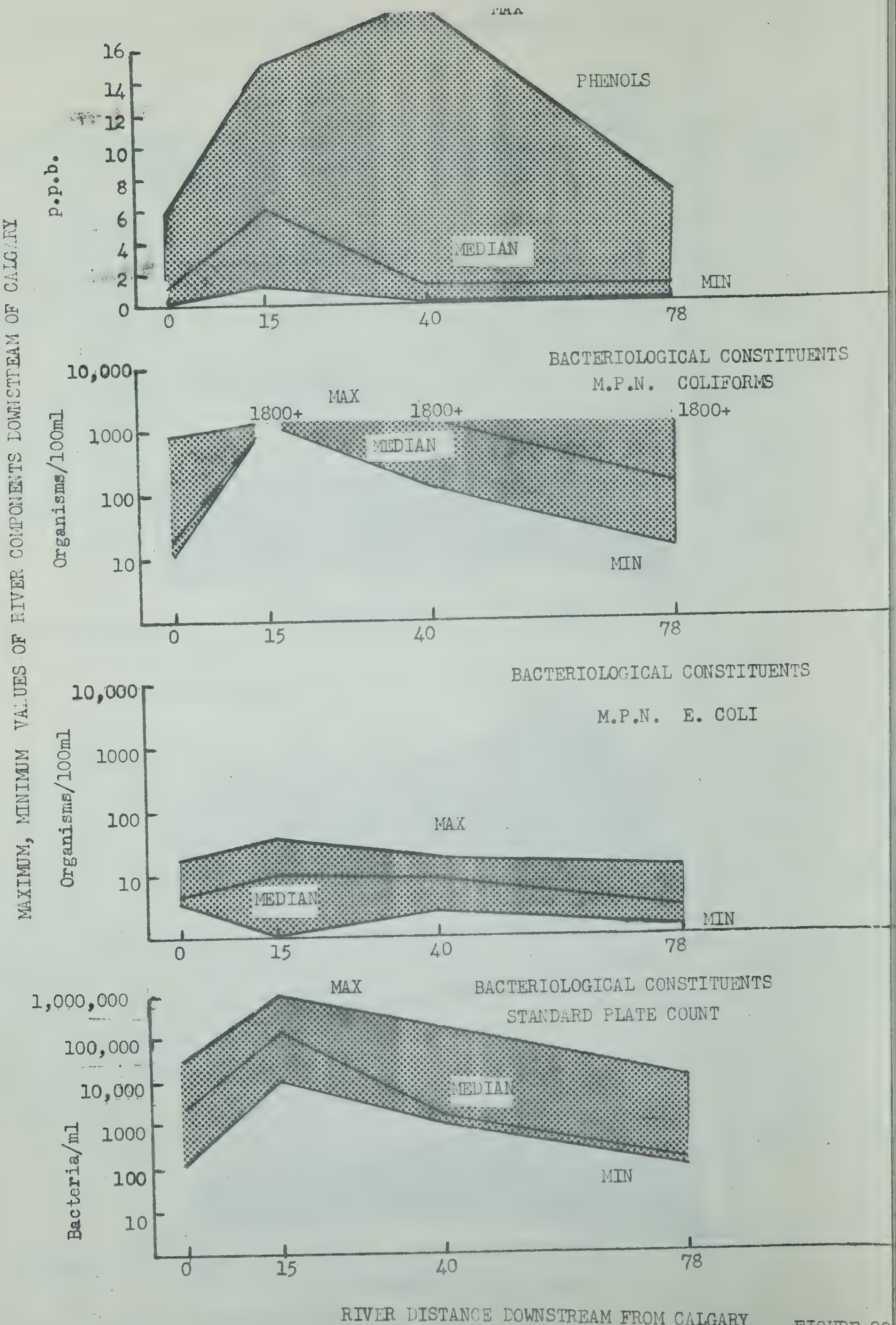
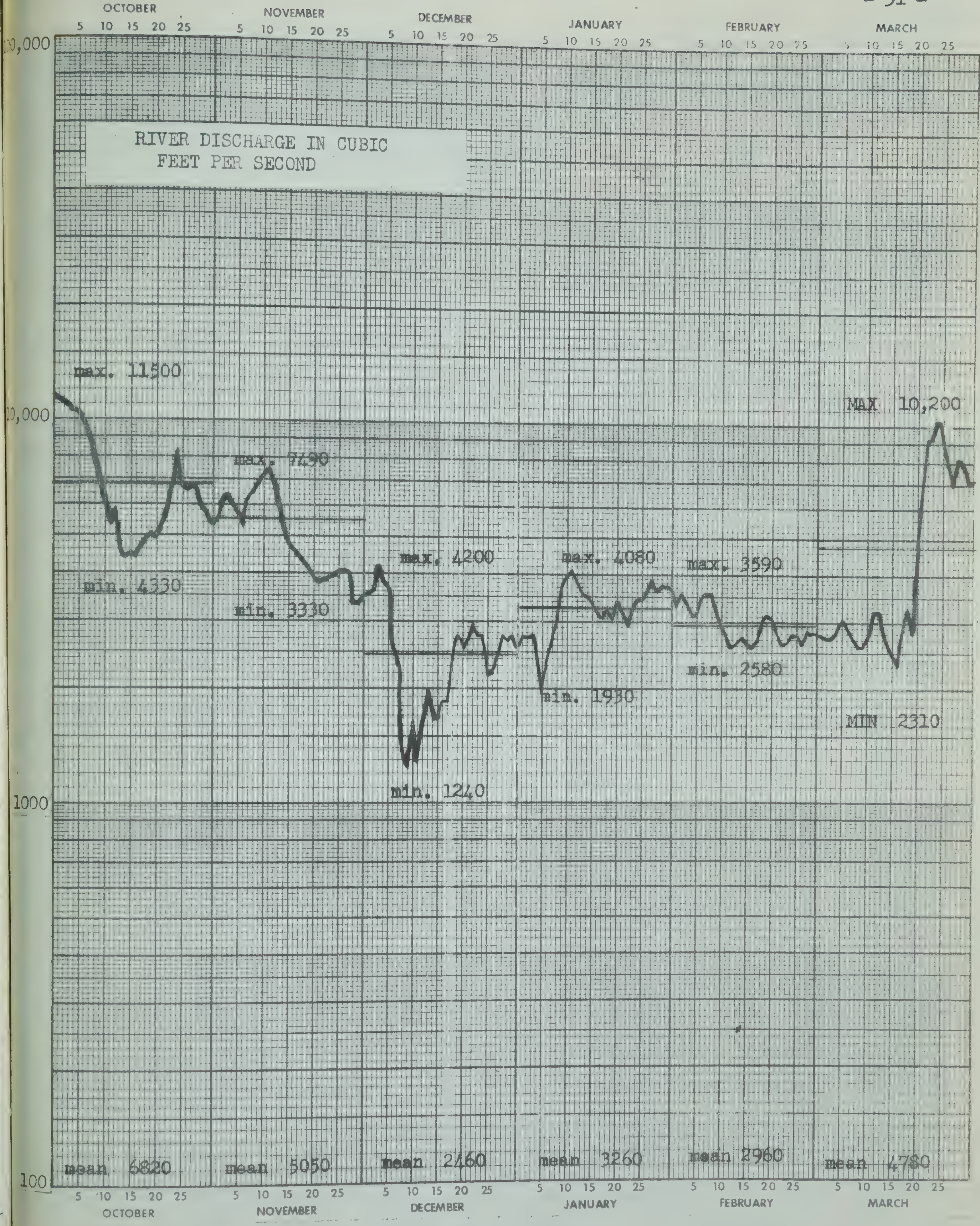
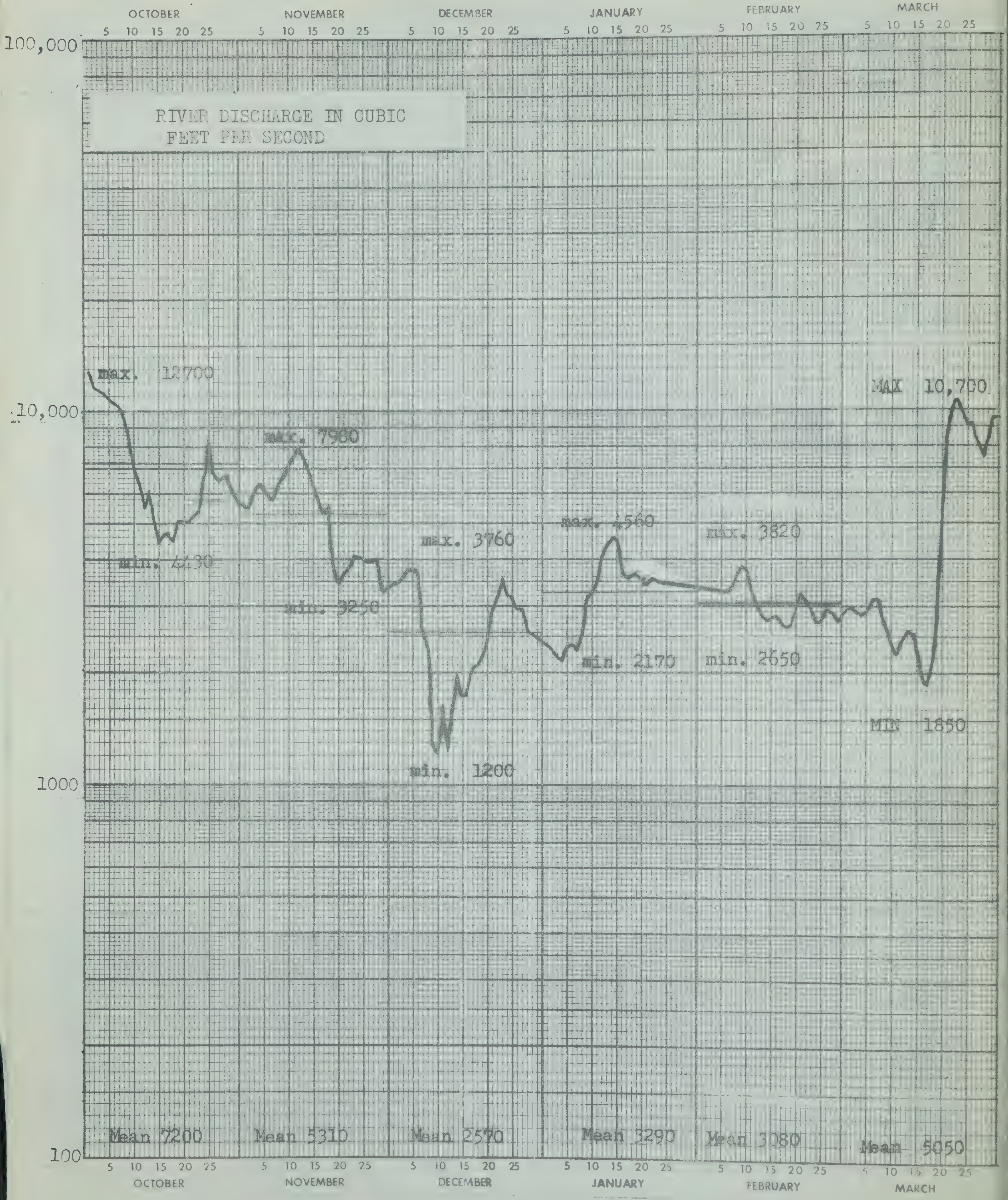

MAXIMUM, MINIMUM VALUES OF RIVER COMPONENTS DOWNSTREAM OF CALGARY
MAX
PHENOLS
p.p.b.
16
14
12
10
8
6
4
2
0
MEDIAN
MIN
0
15
40
78
BACTERIOLOGICAL CONSTITUENTS
M.P.N. COLIFORMS
10,000
1000
100
10
Organisms/100ml
MAX
1800+
1800+
1800+
MEDIAN
MIN
0
15
40
78
BACTERIOLOGICAL CONSTITUENTS
M.P.N. E. COLI
10,000
1000
100
10
Organisms/100ml
MAX
MEDIAN
MIN
0
15
40
78
MAX
BACTERIOLOGICAL CONSTITUENTS
STANDARD PLATE COUNT
1,000,000
100,000
10,000
1000
100
10
Bacteria/ml
MEDIAN
MIN
0
15
40
78
RIVER DISTANCE DOWNSTREAM FROM CALGARY

FIGURE 22



SOUTH SASKATCHEWAN RIVER AT MEDICINE HAT STATION NO. 5A4-1

FIGURE 23



SOUTH SASKATCHEWAN RIVER AT HWY. # 41 BRIDGE ST. ID. NO. 05AK00

FIGURE 24

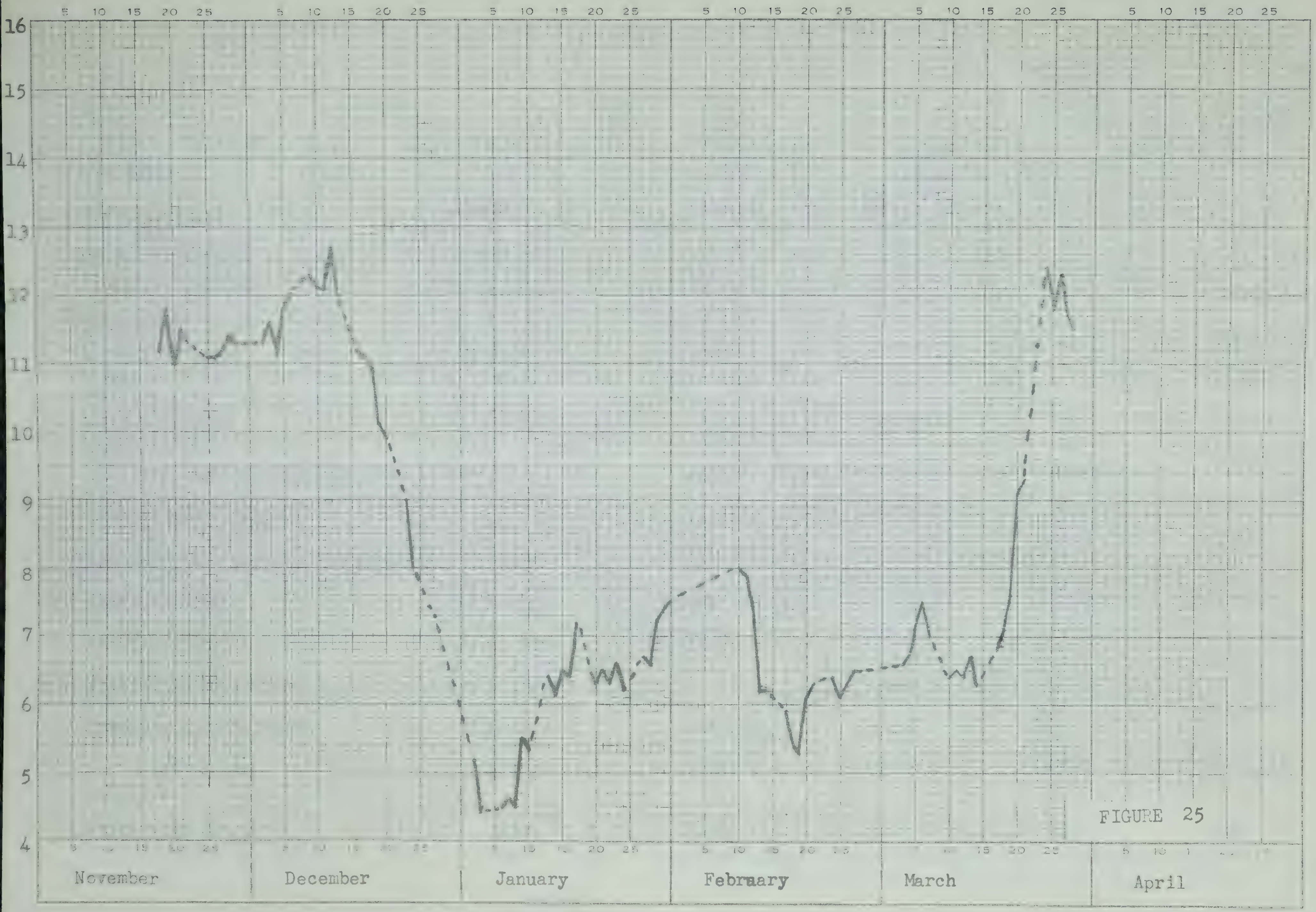


FIGURE 25

DISSOLVED OXYGEN IN SOUTH SASKATCHEWAN AT MEDICINE HAT

TABLE I

TOTAL LOADING TO RIVER RIVER FLOW C.F.S.	October 21/68 3690	November 18/68 1090	December 16/68 1340	January 20/69 2060	February 17/69 1630
BIOCHEMICAL OXYGEN DEMAND 5 - DAY 20 DEG.	10719.6	84324.8	66149.8	58699.1	81739.9
CHEMICAL OXYGEN DEMAND	29900.5	192249.8	138831.4	119185.8	159221.1
ALKALINITY AS CACO3	888.0	54.0	880.9	212.0	19.0
TOTAL ALKALINITY AS CACO3	113924.0	149909.4	186157.6	186394.0	201320.6
TOTAL RESIDUE	191050.6	408264.8	377964.3	397982.7	435282.2
IGNITION LOSS OF TOTAL RESIDUE	64097.0	164073.5	148802.9	119424.9	128269.0
NONFILTRABLE RESIDUE	14749.8	57869.8	55460.4	51804.5	78157.6
IGNITION LOSS OF NONFILTRABLE RESIDUE	11923.0	57285.9	34431.1	42508.4	57188.5
OILS & GREASES	1660.2	9275.0	166754	14836.6	17546.2
PHENOLS	12.1	26.7	36.4	26.8	22.2
CHLORIDES	11619.5	37902.5	32686.6	49162.6	61398.1
PHOSPHATES	637.0	8919.1	11264.4	16534.2	13044.7
AMMONIA NITROGEN	9110.5	10562.4	13469.7	16508.2	8064.8
NITRATE NITROGEN	5639.7	275.0	1640.5	1940.7	1384.2
SULPHATES	180524	21739.0	21550.9	20302.0	23701.0
FLUORIDES	61.9	78.9	136.7	80.2	110.6
COPPER		36.2	71.5	22.4	53.2

TABLE II

(1968 - 1969)

RESULTS OF ANALYSIS OF COMPOSITE SAMPLES

BOW RIVER AT STIER'S RANCH

Analyses	October 21-22/68		November 18-19/68		December 17/68		January 20-21/69		February 17-18/69	
Dissolved Oxygen mg/1	15:00	10.6 @ 7°C	11:30	9.6 @ 0°C	00:45	8.4 @ 0°C	12:00	[illegible]	12:30	11.0 @ 0°C
	18:00	11.0 @ 7°C	14:30	10.1 @ 0°C	05:00	8.1 @ 0°C	15:00	8.6 @ 0°C	15:30	9.6 @ 0°C
	21:00	10.4 @ 6°C	17:30	9.4 @ 0°C	09:00	8.1 @ 0°C	18:00	9.7 @ 0°C	18:30	10.7 @ 0°C
	24:00	10.3 @ 6°C	20:30	7.9 @ 0°C	11:30	9.2 @ 0°C	21:00	[illegible] @ 0°C	22:30	9.8 @ 0°C
	03:00	10.4 @ 5.5°C	23:30	7.3 @ 0°C	16:00	10.2 @ 0°C	24:00	[illegible] @ 0°C	01:30	9.6 @ 0°C
	06:00	10.4 @ 5°C	02:30	6.5 @ 0°C	20:00	7.6 @ 0°C	03:00	8.5 @ 0°C	05:30	9.6 @ 0°C
	09:00	10.9 @ 4.5°C	05:30	5.9 @ 0°C			06:00	7.4 @ 0°C	08:00	9.7 @ 0°C
	12:00	10.5 @ 6°C	08:30	6.2 @ 0°C			10:00	7.6 @ 0°C		
Biochemical Oxygen Demand 20°, 5-day mg/1	15:00	2.95	11:30	3.68	00:45	7.00	[illegible]	3.15	12:30	2.50
	18:00	6.90	14:30	3.78	05:00	7.20	[illegible]	2.00	15:30	[illegible]
	21:00	7.45	17:30	3.55	09:00	6.18	[illegible]	1.40	18:30	[illegible]
	24:00	6.80	20:30	5.70	11:30	1.93	21:00	2.10	22:30	[illegible]
	03:00	7.85	23:30	3.70	16:00	2.13	[illegible]	1.60	01:30	6.30
	06:00	7.30	02:30	5.60	20:00	7.15	03:00	2.05	05:30	7.35
	09:00	5.20	05:30	5.80			06:00	[illegible]	08:00	6.90
	12:00	3.30	08:30	4.70			10:00	2.85		
Barometric Pressure Inches Hg	26.45		26.50		26.70		26.50		26.85	

TABLE III

BOW RIVER USERS AND EFFLUENT DISCHARGES

Source	Type of Sewage and Treatment
British American Oil Company	Industrial Waste - foul water stripper
Imperial Oil Limited	Industrial Waste - A.P.I. Separator
Cominco	Industrial Waste - None
Western co-op Fertilizer	Indsutrial Waste - lagoon
Calgary Sewage Treatment Plant	Domestic Sewage - primary treatment
Banff	Domestic Sewage - none
Canmore	Domestic Sewage - lagoon
Cochrane	Domestic Sewage - Septic tank
Gleichen	Domestic Sewage - Septic tank

DRINKING WATER USERS

User	Type of Treatment
Bassano	Pressure filters
Cochrane	Filter, Chlorination

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APPENDIX B

BR1 Background Data of Bow River at Cushing Bridge - B - 1

BR2 Background Data of Bow River at Stier's Ranch - B - 4

BR3 Background Data of Bow River at Carseland - B - 7

APPENDIX A

EXPLANATORY NOTES AND DEFINITIONS

FOR

PARAMETERS USED IN THIS PAPER

1. Algae-	A microbial plant growth present in water supplies, causing taste and odour.
2. Alkalinity-	Capacity of a water to neutralize acids, caused by the presence of bicarbonate and carbonate ions and hydroxide.
3. Ammonia Nitrogen- (NH_3-N)	commonly called a nutrient as it is an essential part of protein in all living organisms; produces oxygen demand.
4. Biochemical Oxygen-Demand, 5-Day @ 20° (B.O.D.)	the amount of molecular oxygen required to stabilize the decomposable matter present in a water; commonly found by a five-day incubation period at 20°C. It measures the effect of a combination of substances and conditions.
5. Carbon Chloroform-Extract (CCE)	a measure of the amount of industrial organic contaminants, particularly synthetic chemicals, present in a water supply.
6. Chemical Oxygen-Demand (C.O.D.)	the amount of molecular oxygen required to oxidize that portion of the organic matter in a sample which is susceptible to oxidation by a strong chemical oxidant.
7. Coliform-	a type of bacteria generally present in water in the same concentrations as pathogenic organisms, and used as an indication of the concentration of pathogenes.
8. Composite Sample-	a series of grab samples generally taken for a 24-hour period indicative of an average of the concentrations of contaminants for the sampling period.
9. Colour-	taken as the color of the liquid after turbidity is removed; due to decay of organic material in the water.
10. Dissolved Oxygen- (D.O.)	oxygen present in the water supply, indicating the ability of a stream to assimilate organic matter.
11. Grab sample-	a single sample representative of stream flow, usually collected at middepth in the middle of the stream.
12. Most Probable Number- (M.P.N.)	of coliform organisms in a water sample; it is the density more likely to produce a particular result.

13. Non -filtrable residue- see Suspended Solids.

14. Oils and Greases-	Their insolubility in water and low specific gravity reduce reaeration of the stream.
15. pH-	a measure of the alkalinity or acidity of a water supply. A value of 7.0 indicates neutral water, below 7.0 is acidic and above 7.0 is alkaline or basic.

16. Phenols-	an organic compound from industrial waste or naturally occurring with its own characteristic taste and odor. Chlorination will intensify the taste and odor.
17. Phosphate- (PO_4)	commonly called a nutrient, it will interfere with coagulation and promote algal growth.
18. Suspended Solids-	small particles such as clay, organic materials, or plankton which are in suspension in the water.
19. Threshold Odor Number- (T.O.N.)	a value given to a water to indicate its relative strength of odour; the number of times the odor-bearing sample has to be diluted with odor-free water for the odor to be just detectable.
20. Turbidity-	a measure of the extent to which the intensity of light passing through the water is reduced by the suspended matter.

References:

1. A.P.H.A., A.W.W.A., W.P.C.F., Standard Methods for the Examination of Water and Wastewater, 12th Edition, 1965, American Public Health Association, Inc., New York City.

2. Clark, J.W., and Viessman Jr., Warren, Water Supply and Pollution Control, International Textbook Company, Scranton, Pennsylvania.

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4. Province of Saskatchewan, Water Quality Criteria, April 1968.

WATER POLLUTION CONTROL

ODOR TYPE

Abbreviation	Nature of Odor	Description - Such as Odors of
A	Aromatic (spicy)	Camphor, cloves, lavender, lemon
AC	cucumber	Synura
B	Balsamic (flowery)	Geranium violet, vanilla
BG	geranium	Asterionella
BN	nasturtium	Aphanizomenon
BS	sweetish	Coelosphaerium
BV	violets	Mallomonas
C	Chemical	Industrial wastes or treatment chemicals
CC	chlorinous	Free chlorine
CH	hydrocarbons	Oil Refinery wastes
CM	medicinal	Phenol and iodoform
CS	sulfuretted	Hydrogen Sulfide
D	Disagreeable	(Pronounced unpleasant odors)
DF	fishy	Uroglenopsis and Dinobryon
DP	pigpen	Anabaena
DS	septic	Stale sewage
E	Earthy	Damp earth
EP	peaty	Peat
G	Grassy	Crushed grass
M	Musty	Decomposing straw
MN	moldy	Damp cellar
V	Vegetable	Root vegetables
WR	Wood Resin	

BR1 BOW RIVER CUSHING BRIDGE 1968-69

DAY MONTH YEAR	14 AUG 1968	22 OCT 1968	19 NOV 1968	16 DEC 1968	22 JAN 1969	17 FEB 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1200	1030	800	1030	900	900
TEMPERATURE, DEG.CENT.	12.0	4.5	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	26.80	26.40	26.60	26.45	26.50	*0.00
DISSOLVED OXYGEN, MG/L	9.3	10.7	10.2	12.2	12.7	12.1
PERCENT SATURATION	96.	94.	79.	95.	98.	*00.
BIOCHEM. OX. DEMAND MG/L	1.0	1.5	0.4	0.8	1.0	0.6
HYDROGEN ION CONC.,PH	8.5	8.7	8.0	8.3	8.1	7.9
ALKALINITY MG/L	107	130	151	138	125	136
THRESHOLD ODOR NO.,TYPE	2 M	2 M	2 M	4 M	1 M	1 M
TOTAL RESIDUE MG/L ,	182	192	166	232	214	212
IGNITION LOSS MG/L	92	76	68	108	40	24
TURBIDITY AS SIO2 MG/L	3	4	6	6	16	5
TOTAL HARDNESS MG/L	126	170	193	178	162	166
CHLORIDES MG/L	1	3	3	0	1	2
AMMONIA NITROGEN MG/L	0.2	0.2	0.0	0.1	0.1	0.3
NITRATE NITROGEN MG/L	0.0	0.2	0.3	0.1	0.1	0.1
SULFATES AS SO4 MG/L	34	44	50	98	50	52
TOTAL PHOS.AS PO4 MG/L	0.0	0.0	0.0	0.1	0.1	0.7
PHENOLS PPB	0	3	1	6	0	1
OILS & GREASES MG/L	0.7	0.1	1.3	*.0	1.2	2.7
FLUORIDES MG/L	0.18	0.07	0.34	0.18	0.19	0.22
COLIFORM M.P.N./100ML.	920.	540.	22.	130.	17.	29.
MPN OF E COLI/100ML	26.0	32.0	6.8	12.0	6.8	6.1
STD. PLATE COUNT/ML	45000	16000	750	4000	*00000	140
RIVER DISCHARGE C.F.S.	3410.	3650.	1170.	1340.	2490.	1630.

* DENOTES DATA NOT AVAILABLE

BR1 BOW RIVER CUSHING BRIDGE 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	11.20	12.70	9.30	10.70
BOD MG/L	0.88	1.50	0.40	0.80
HYDROGEN ION CONC.,PH	8.25	8.70	7.90	8.10
ALKALINITY MG/L	131.17	151.00	107.00	130.00
TOTAL RESIDUE MG/L	199.67	232.00	166.00	232.00
INGITION LOSS MG/L	68.00	108.00	24.00	68.00
TURBIDITY AS SIO2 MG/L	6.67	16.00	3.00	5.00
TOTAL HARDNESS MG/L	165.83	193.00	126.00	166.00
CHLORIDES MG/L	1.67	3.00	0.00	1.00
AMMONIA NITROGEN MG/L	0.15	0.30	0.00	0.10
SULFATES AS SO4 MG/L	54.67	98.00	34.00	50.00
NITRATE NITROGEN MG/L	0.13	0.30	0.00	0.10
TOTAL PHOS.AS PO4 MG/L	0.15	0.70	0.00	0.00
PHENOLS PPB	1.83	6.00	0.00	1.00
OILS AND GREASES MG/L	1.20	2.70	0.10	1.20
FLUORIDES MG/L	0.20	0.34	0.07	0.18
COLIFORM M.P.N./100ML.	276.33	920.00	17.00	29.00
M.P.N. OF E COLI/100ML	14.95	32.00	6.10	6.80
STANDARD PLATE COUNT/ML	13178.	45000.	140.	4000.

BR2 BOW RIVER STIERS RANCH

DAY MONTH YEAR	11 AUG 196[illegible]	14 AUG 196[illegible]	15 AUG 1968	22 AUG 1968	11 SEP 1968	12 SEP 1968	2[illegible] OCT 196[illegible]
COMPOSITE OR GRAB SAMPLE	G	G	C	G	G	C	C
INITIAL SAMPLING TIME	111[illegible]	80[illegible]	800	1300	1000	1030	150[illegible]
TEMPERATURE, DEG.CENT.	13.[illegible]	13.[illegible]	13.0	*0.0	*0.0	14.5	6.0
BAROMETRIC PRES. IN.HG	*0.0[illegible]	*0.0[illegible]	*0.00	*0.00	*0.00	*0.00	26.45
DISSOLVED OXYGEN, MG/L	11.[illegible]	8.[illegible]	6.8	*0.0	10.4	10.2	10.6
PERCENT SATURATION	*00.	*00.	*00.	*00.	*00.	*00.	96.
BIOCHEM. OX. DEMAND MG/L	1.[illegible]	3.[illegible]	3.6	1.3	2.1	3.8	4.5
HYDROGEN ION CONC.,PH	8.[illegible]	8.[illegible]	8.0	8.8	8.7	7.7	8.4
ALKALINITY MG/L	10[illegible]	13[illegible]	126	100	114	119	133
THRESHOLD ODOR NO.,TYPE	8 [illegible]	4 [illegible]	8 M	8 M	4 M	4 M	2 M
TOTAL SOLIDS MG/L	16[illegible]	19[illegible]	174	138	160	172	168
IGNITION LOSS MG/L	4[illegible]	6[illegible]	88	54	36	28	50
TURBIDITY AS SIO2 MG/L	[illegible]	[illegible]	3	9	5	8	3
TOTAL HARDNESS MG/L	13[illegible]	13[illegible]	138	132	141	144	170
CHLORIDE MG/L	[illegible]	[illegible]	4	5	3	5	5
AMMONIA NITROGEN MG/L	0.[illegible]	0.[illegible]	0.6	0.2	0.3	0.7	0.8
NITRATE NITROGEN MG/L	0.[illegible]	0.[illegible]	0.6	0.4	0.4	0.6	0.9
SULFATE AS SO4 MG/L	3[illegible]	3[illegible]	38	36	40	*00	*00
PHOSPHATES AS PO4 MG/L	0.[illegible]	0.[illegible]	0.1	0.4	0.3	0.5	0.4
PHENOLS PPB	[illegible]	1[illegible]	11	1	3	13	6
OILS & GREASES MG/L	5.[illegible]	2.[illegible]	12.8	2.1	0.9	1.0	0.1
FLUORIDES MG/L	0.3[illegible]	0.1[illegible]	0.18	0.29	0.29	*.00	*.00
COLIFORM M.P.N./100ML.	1800[illegible]	1800.+	1800.+	*000.	1800.+	1800.+	1800.+
MPN OF E COLI/100ML	12.0	7.[illegible]	1.8	*00.0	0.0	3.6	59.0
STANDARD PLATE COUNT/ML	1800[illegible]	[illegible]5000[illegible]	300000	*00000	1000000	900000	220000

* DENOTES DATA NOT AVAILABLE

DETERGENTS MG/1 0.5

DAY MONTH YEAR	26 NOV [illegible]	17 DEC [illegible]	[illegible] JAN [illegible]	[illegible]
COMPOSITE OR GRAB SAMPLE	C	C	C	C
INITIAL SAMPLING TIME	120[illegible]	90[illegible]	1100	110[illegible]
TEMPERATURE, DEG.CENT.	0.[illegible]	0.[illegible]	[illegible].0	0.[illegible]
BAROMETRIC PRES. IN.HG	26.5[illegible]	26.7[illegible]	26.50	26.8[illegible]
DISSOLVED OXYGEN, MG/L	7.[illegible]	8.[illegible]	[illegible].6	10.[illegible]
PERCENT SATURATION	60[illegible]	66[illegible]	[illegible]7.	76.
BIOCHEM. OX. DEMAND MG/L	5.[illegible]	5.[illegible]	[illegible].4	5.[illegible]
HYDROGEN ION CONC.,PH	8.[illegible]	7.[illegible]	[illegible].8	7.[illegible]
ALKALINITY MG/L	14[illegible]	14[illegible]	[illegible]55	14[illegible]
THRESHOLD ODOR NO.,TYPE	4 [illegible]	8 C[illegible]	4 M	8 [illegible]
TOTAL SOLIDS MG/L	25[illegible]	27[illegible]	[illegible]52	22[illegible]
IGNITION LOSS MG/L	9[illegible]	17[illegible]	82	4[illegible]
TURBIDITY AS SIO2 MG/L	[illegible]	1[illegible]	6	[illegible]
TOTAL HARDNESS MG/L	19[illegible]	18[illegible]	[illegible]80	18[illegible]
CHLORIDE MG/L	[illegible]	[illegible]	4	[illegible]
AMMONIA NITROGEN MG/L	2.[illegible]	1.[illegible]	[illegible].3	1.[illegible]
NITRATE NITROGEN MG/L	1.[illegible]	0.[illegible]	[illegible].7	0.[illegible]
PHOSPHATES AS PO4 MG/L	1.[illegible]	1.[illegible]	[illegible].0	1.[illegible]
PHENOLS PPB	[illegible]	[illegible]	5	[illegible]
OILS & GREASES MG/L	1.[illegible]	2.[illegible]	[illegible].2	2.[illegible]
COLIFORM M.P.N./100ML.	1800.+	1800.+	*0[illegible]0.	1800.+
MPN OF E COLI/100ML	12.[illegible]	14.[illegible]	4[illegible].0	10.[illegible]
STANDARD PLATE COUNT/ML	8200[illegible]	1000[illegible]	18[illegible]00	1200[illegible]

* DENOTES DATA NOT AVAILABLE

DETERGENTS MG/L 0.12 0.12 0.15 0.08

[illegible] BOW RIVER STIERS RANCH 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	9.22	11.10	6.80	8.60
BOD MG/L	3.48	5.30	1.20	3.80
HYDROGEN ION CONC.,PH	8.19	8.90	7.70	8.00
ALKALINITY MG/L	129.00	155.00	100.00	133.00
TOTAL RESIDUE MG/L	197.45	278.00	138.00	138.00
INGITION LOSS MG/L	68.55	178.00	28.00	54.00
TURBIDITY AS SIO2 MG/L	5.82	10.00	3.00	6.00
TOTAL HARDNESS MG/L	157.00	190.00	132.00	144.00
CHLORIDES MG/L	[illegible]	[illegible]	[illegible]	[illegible]
AMMONIA NITROGEN MG/L	0.92	2.00	0.20	0.70
SULFATES AS SO4 MG/L	37.60	40.00	36.00	38.00
NITRATE NITROGEN MG/L	[illegible]	1.20	[illegible]	[illegible]
TOTAL PHOS.AS PO4 MG/L	0.71	1.50	0.10	0.50
PHENOLS PPB	6.64	15.00	1.00	6.00
OILS AND GREASES MG/L	3.00	12.80	0.10	2.10
FLUORIDES MG/L	0.26	0.34	0.18	0.29
COLIFORM M.P.N./100ML.		1800 +		
M.P.N. OF E COLI/100ML	16.47	59.00	0.00	10.00
STANDARD PLATE COUNT/ML	348222.	1000000.	10000	220000.

BR3 BOW RIVER CARSELAND

DAY MONTH YEAR	21 OCT 1968	19 NOV 1968	17 DEC 1968	22 JAN 1969	18 FEB 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G
INITIAL SAMPLING TIME	1100	1800	140[illegible]	1000	930
TEMPERATURE, DEG.C N.	5.0	0.0	0.[illegible]	0.0	0.0
BAROMETRIC PRES. IN.HG	26.93	26.65	27.0[illegible]	26.90	27.35
DISSOLVED OXYGEN, MG/L	11.0	11.5	11.0	8.2	8.2
PERCENT SATURATION	95.	88.	83.	62.	61.
BIOCHEM. OX. DEMAND MG/L	3.0	3.3	4.1	1.4	1.8
HYDROGEN ION CONC., PH	8.3	8.1	7.[illegible]	7.7	7.5
ALKALINITY MG/L	144	146	151	148	142
THRESHOLD ODOR NO., TYPE	4 M	8 M	8 [illegible]	4 M	4 M
TOTAL SOLIDS MG/L	248	266	27[illegible]	256	204
IGNITION LOSS MG/L	74	102	13[illegible]	66	50
TURBIDITY AS SIO2 MG/L	3	7	[illegible]	5	9
TOTAL HARDNESS MG/L	160	216	190	192	180
CHLORIDES MG/L	5	5	[illegible]	4	3
AMMONIA NITROGEN MG/L	0.7	1.4	1.[illegible]	1.0	1.0
NITRATE NITROGEN MG/L	0.5	1.5	1.[illegible]	1.0	0.8
PHOSPHATE AS PO4 MG/L	0.3	0.8	0.[illegible]	0.9	0.7
PHENOLS PPB	9	1	2[illegible]	1	0
OILS & GREASES MG/L	0.1	1.6	1.[illegible]	1.9	2.4
COLIFORM M.P.N./100 ML.	1800.+	1800.+	430.	170.	1800.+
MPN OF E.COLI/100ML.	4.	31.	9.	22.	9.
STANDARD PLATE COUNT/ML	260000	3000	1900	*00000	900
RIVER DISCHARGE C.F.S.	4730.	*0000.	*0000.	*0000.	*0000.

* DENOTES DATA NOT AVAILABLE

BR3 BOW RIVER CARSELAND

1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	9.98	11.50	8.20	11.00
BOD MG/L	2.72	4.10	1.40	3.00
HYDROGEN ION CONC.,PH	7.90	8.30	7.50	7.90
ALKALINITY MG/L	146.20	151.00	142.00	146.00
TOTAL RESIDUE MG/L	250.00	276.00	204.00	256.00
INGITION LOSS MG/L	85.20	134.00	50.00	74.00
TURBIDITY AS SIO2 MG/L	6.20	9.00	3.00	7.00
TOTAL HARDNESS MG/L	187.60	216.00	160.00	190.00
CHLORIDES MG/L	4.40	5.00	3.00	5.00
AMMONIA NITROGEN MG/L	1.08	1.40	0.70	1.00
NITRATE NITROGEN MG/L	1.06	1.50	0.50	1.00
TOTAL PHOS.AS PO4 MG/L	0.72	0.90	0.30	0.80
PHENOLS PPB	7.20	25.00	0.00	1.00
OILS AND GREASES MG/L	1.50	2.40	0.10	1.60
COLIFORM M.P.N./100ML.		1800.00 +	170.00	
M.P.N. OF E COLI/100ML	15.02	31.00	3.70	9.20
STANDARD PLATE COUNT/ML	66450.	260000.	900.	1900.

BR4 BOW RIVER CLUNY

DAY MONTH YEAR	23 OCT 1968	19 NOV 1968	17 DEC 1968	22 JAN 1969	19 FEB 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G
INITIAL SAMPLING TIME	1215	1400	1445	1100	1100
TEMPERATURE, DEG.CENT.	4.5	0.0	0.0	0.0	0.0
BAROMETRIC PRES., IN.HG	27.25	26.70	27.35	27.20	27.52
DISSOLVED OXYGEN, MG/L	10.9	6.9	10.8	7.3	7.2
PERCENT SATURATION	92.	53.	81.	55.	54.
BIOCHEM. OX. DEMAND MG/L	1.5	2.6	1.0	2.1	4.2
HYDROGEN ION CONC.,PH	8.7	8.2	7.8	7.7	7.6
ALKALINITY MG/L	134	165	149	151	142
THRESHOLD ODOR NO.,TYPE	4 M	8 M	8 M	4 M	8 M
TOTAL RESIDUE MG/L ,	266	290	288	254	258
IGNITION LOSS MG/L	66	78	198	74	58
TURBIDITY AS SIO2 MG/L	6	7	9	5	54
TOTAL HARDNESS MG/L	176	204	198	202	176
CHLORIDES MG/L	7	7	5	6	3
AMMONIA NITROGEN MG/L	0.5	0.9	1.1	0.8	0.8
NITRATE NITROGEN MG/L	0.5	1.4	1.5	1.1	0.3
SULFATES AS SO4 MG/L	48	68	66	56	68
TOTAL PHOS.AS PO4 MG/L	0.4	0.3	0.7	0.6	0.7
PHENOLS PPB	0	1	7	0	2
OILS & GREASES MG/L	0.0	1.1	0.8	0.4	2.1
FLUORIDES MG/L	0.03	0.28	0.19	0.19	0.16
COLIFORM M.F.--/100ML	1000.*	[illegible]	[illegible]	[illegible]	[illegible]
MPN OF E COLI/100ML	4.0	1.8	3.7	22.0	6.1
STD. PLATE COUNT/ML	21000	120	1300	*00000	200

* DENOTES DATA NOT AVAILABLE

BR4 BOW RIVER CLUNY 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	8.62	10.90	6.90	7.30
BOD MG/L	2.28	4.20	1.00	2.10
HYDROGEN ION CONC.,PH	8.00	8.70	7.60	7.80
ALKALINITY MG/L	148.20	165.00	134.00	149.00
TOTAL RESIDUE MG/L	271.20	290.00	254.00	254.00
INGITION LOSS MG/L	94.80	198.00	58.00	74.00
TURBIDITY AS SIO2 MG/L	16.20	54.00	5.00	7.00
TOTAL HARDNESS MG/L	191.20	204.00	176.00	198.00
CHLORIDES MG/L	5.60	7.00	3.00	6.00
AMMONIA NITROGEN MG/L	0.82	1.10	0.50	0.80
SULFATES AS SO4 MG/L	61.20	68.00	48.00	66.00
NITRATE NITROGEN MG/L	0.96	1.50	0.30	1.10
TOTAL PHOS.AS PO4 MG/L	0.54	0.70	0.30	0.60
PHENOLS PPB	2.00	7.00	0.00	1.00
OILS AND GREASES MG/L	0.88	2.10	0.00	0.80
FLUORIDES MG/L	0.17	0.28	0.03	0.19
COLIFORM M.P.N./100ML.		1800.00 +	22.00	240.00
M.P.N. OF E COLI/100ML	7.52	22.00	1.80	4.00
STANDARD PLATE COUNT/ML	5655.	21000.	120.	200.

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BR6 BOW RIVER HWY#36 BRIDGE

          DAY                          29
          MONTH                       JAN
          YEAR                       1969

COMPOSITE OR GRAB SAMPLE             G

INITIAL SAMPLING TIME              1530

TEMPERATURE, DEG.CENT.              0.0

DISSOLVED OXYGEN, MG/L              9.6

BIOCHEM. OX. DEMAND MG/L            1.6

HYDROGEN ION CONC.,PH               7.9

ALKALINITY   MG/L                   161

THRESHOLD ODOR NO.,TYPE           4   M

TOTAL RESIDUE MG/L   ,              244

IGNITION LOSS MG/L                   92

TURBIDITY AS SIO2 MG/L                5

TOTAL HARDNESS    MG/L              182

CHLORIDES         MG/L                4

AMMONIA NITROGEN  MG/L              1.1

NITRATE NITROGEN  MG/L              1.3

SULFATES  AS SO4  MG/L               56

TOTAL PHOS.AS PO4 MG/L              0.7

PHENOLS            PPB                2

FLUORIDES  MG/L                    0.25
                   * DENOTES DATA NOT AVAILABLE
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814 BOW RIVER AT COCHRANE BRIDGE 68-69

DAY	12
MONTH	SEP
YEAR	1968
COMPOSITE OR GRAB SAMPLE	G
INITIAL SAMPLING TIME	1400
TEMPERATURE, DEG.CENT.	13.0
BAROMETRIC PRES. IN.HG	26.00
DISSOLVED OXYGEN, MG/L	9.4
PERCENT SATURATION	102.
BIOCHEM. OX. DEMAND MG/L	1.2
HYDROGEN ION CONC.,PH	8.3
ALKALINITY MG/L	108
THRESHOLD ODOR NO.,TYPE	4 M
TOTAL RESIDUE MG/L ,	144
IGNITION LOSS MG/L	40
TURBIDITY AS SIO2 MG/L	5
TOTAL HARDNESS MG/L	134
CHLORIDES MG/L	3
AMMONIA NITROGEN MG/L	0.5
NITRATE NITROGEN MG/L	0.1
TOTAL PHOS.AS PO4 MG/L	0.1
PHENOLS PPB	1
OILS & GREASES MG/L	1.3
COLIFORM M.P.N./100ML.	33.
MPN OF E COLI/100ML	2.0
STD. PLATE COUNT/ML	85000

* DENOTES DATA NOT AVAILABLE

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B15 BOW RIVER AT BEAR PAW DAM                        68-69

          DAY                          12
          MONTH                       SEP
          YEAR                       1968

COMPOSITE OR GRAB SAMPLE               G

INITIAL SAMPLING TIME                1030

TEMPERATURE, DEG.CENT.                [illegible]

BAROMETRIC PRESS. IN.HG.            26.10

DISSOLVED OXYGEN, MG/L                9.8

PERCENT SATURATION                   106.

BIOCHEM. OX. DEMAND MG/L              1.0

HYDROGEN ION CONC.,PH                 8.2

ALKALINITY    MG/L                    137

[illegible]                          [illegible]

TOTAL RESIDUE MG/L    ,               120

IGNITION LOSS MG/L                     10

TURBIDITY AS SIO2 MG/L                  6

TOTAL HARDNESS      MG/L              130

CHLORIDES           MG/L                1

AMMONIA NITROGEN    MG/L              0.2

NITRATE NITROGEN    MG/L              0.0

TOTAL PHOS.AS PO4 MG/L                0.1

PHENOLS                PPB              3

OILS & GREASES    MG/L                1.0

COLIFORM M.P.N./100ML.                27.

MPN OF E COLI/100ML                   4.0

STD. PLATE COUNT/ML                 62000

                  * DENOTES DATA NOT AVAILABLE
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816 BOW RIVER AT BAKERS HOSPITAL 68-69

DAY	13
MONTH	AUG
YEAR	1968
COMPOSITE OR GRAB SAMPLE	G
INITIAL SAMPLING TIME	1500
TEMPERATURE, DEG.CENT.	12.0
BAROMETRIC PRES. IN.HG	26.75
BIOCHEM. OX. DEMAND MG/L	0.8
HYDROGEN ION CONC.,PH	8.5
ALKALINITY MG/L	75
THRESHOLD ODOR NO.,TYPE	8 M
TOTAL RESIDUE MG/L ,	154
IGNITION LOSS MG/L	34
TURBIDITY AS SIO2 MG/L	6
TOTAL HARDNESS MG/L	122
CHLORIDES MG/L	0
AMMONIA NITROGEN MG/L	0.1
NITRATE NITROGEN MG/L	0.0
SULFATES AS SO4 MG/L	32
TOTAL PHOS.AS PO4 MG/L	0.0
PHENOLS PPB	0
OILS & GREASES MG/L	0.0
FLUORIDES MG/L	0.17
COLIFORM M.P.N./100ML.	350.
MPN OF E COLI/100ML	5.5
STD. PLATE COUNT/ML	21000

* DENOTES DATA NOT AVAILABLE

SR1 SHEEP RIVER AT OKOTOKS 68-69

DAY MONTH YEAR	18 NOV 1968	16 DEC 1968	20 JAN 1969	17 FEB 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G
INITIAL SAMPLING TIME	1400	1530	1800	1830
TEMPERATURE, DEG.CENT.	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	26.45	26.40	26.40	26.90
DISSOLVED OXYGEN, MG/L	12.0	11.6	11.7	12.2
PERCENT SATURATION	93.	90.	91.	93.
BIOCHEM. OX. DEMAND MG/L	0.9	0.6	1.0	0.9
HYDROGEN ION CONC.,PH	8.1	8.1	7.8	7.8
ALKALINITY MG/L	183	179	180	175
THRESHOLD ODOR NO.,TYPE	2 M	4 M	1 M	2 M
TOTAL RESIDUE MG/L	290	148	290	294
IGNITION LOSS MG/L	102	62	80	70
TURBIDITY AS SIO2 MG/L	19	5	10	11
TOTAL HARDNESS MG/L	224	160	220	210
CHLORIDES MG/L	6	5	7	4
AMMONIA NITROGEN MG/L	0.2	0.2	0.2	0.2
NITRATE NITROGEN MG/L	0.2	0.1	0.4	0.2
SULFATES AS SO4 MG/L	66	66	68	60
TOTAL PHOS.AS PO4 MG/L	0.0	0.1	0.1	0.2
PHENOLS PPB	1	*0	0	1
OILS & GREASES MG/L	0.8	0.9	0.4	0.0
FLUORIDES MG/L	0.27	*.00	0.23	0.19
COLIFORM M.P.N./100ML.	*000.	1600.+	1800.+	1800.+
MPN OF E COLI/100ML	*00.0	14.0	1600.0	9.2
STD. PLATE COUNT/ML	*00000	2400	*00000	400

* DENOTES DATA NOT AVAILABLE

SR1 SHEEP RIVER AT OKOTOKS 68-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	11.88	12.20	11.60	11.70
BOD MG/L	0.85	1.00	0.60	0.90
HYDROGEN ION CONC.,PH	7.95	8.10	7.80	7.80
ALKALINITY MG/L	179.25	183.00	175.00	179.00
TOTAL RESIDUE MG/L	255.50	294.00	148.00	294.00
INGITION LOSS MG/L	78.50	102.00	62.00	70.00
TURBIDITY AS SIO2 MG/L	11.25	19.00	5.00	10.00
TOTAL HARDNESS MG/L	203.50	224.00	160.00	210.00
CHLORIDES MG/L	5.50	7.00	4.00	5.00
AMMONIA NITROGEN MG/L	0.20	0.20	0.20	0.20
SULFATES AS SO4 MG/L	65.00	68.00	60.00	66.00
NITRATE NITROGEN MG/L	0.23	0.40	0.10	0.20
TOTAL PHOS.AS PO4 MG/L	0.10	0.20	0.00	0.10
OILS AND GREASES MG/L	0.53	0.90	0.00	0.40

SS1 SOUTH SASK. RIVER AT MEDICINE HAT 1968-69

DAY MONTH YEAR	13 NOV 1968	4 DEC 1968	8 JAN 1969	30 JAN 1969	12 FEB 1969	4 MAR 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G	G
INITIAL SAMPLING TIME	1135	1930	1345	1200	1115	1415
TEMPERATURE, DEG.CENT.	2.0	0.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	24.46	28.10	27.70	*0.00	27.35	27.73
DISSOLVED OXYGEN, MG/L	11.6	12.1	5.7	7.6	8.7	9.6
PERCENT SATURATION	103.	88.	42.	*00.	65.	71.
BIOCHEM. OX. DEMAND MG/L	1.1	0.8	1.4	3.0	0.7	1.8
HYDROGEN ION CONC.,PH	7.9	8.0	7.9	7.4	8.0	7.8
ALKALINITY MG/L	132	162	196	172	164	155
THRESHOLD ODOR NO.,TYPE	4 M	8 M	4 M	4 M	4 M	4 M
TOTAL RESIDUE MG/L ,	212	268	262	314	282	266
IGNITION LOSS MG/L	76	114	84	112	66	78
TURBIDITY AS SIO2 MG/L	33	19	9	2	8	5
TOTAL HARDNESS MG/L	155	198	256	192	196	194
CHLORIDES MG/L	3	4	5	4	3	4
AMMONIA NITROGEN MG/L	0.6	0.4	0.7	0.3	0.6	0.3
NITRATE NITROGEN MG/L	0.4	0.4	0.5	0.9	0.6	0.6
SULFATES AS SO4 MG/L	46	58	60	54	64	56
TOTAL PHOS.AS PO4 MG/L	0.2	0.4	0.6	0.8	0.6	0.6
PHENOLS PPB	1	3	1	1	4	1
OILS & GREASES MG/L	0.8	1.2	1.3	0.5	2.5	0.1
FLUORIDES MG/L	0.20	0.24	0.14	0.20	0.15	0.22
COLIFORM M.P.N./100ML.	1800. +	140.	240.	17.	33.	79.
MPN OF E COLI/100ML	7.	7.	11.	0.	2.	17.
STD. PLATE COUNT/ML	7500	2500	300	5700	[illegible]	[illegible]
RIVER DISCHARGE C.F.S.	5260.	3800.	3060.	3730.	2590.	2910.
DETERGENTS MG/L		0.02	0.01		0.0	.003

* DENOTES DATA NOT AVAILABLE

SS1 SOUTH SASK. RIVER AT MEDICINE HAT 1968-69

	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	9.22	12.10	5.70	8.70
BOD MG/L	1.47	3.00	0.70	1.10
HYDROGEN ION CONC.,PH	7.83	8.00	7.40	7.90
ALKALINITY MG/L	163.50	196.00	[illegible]	162.00
TOTAL RESIDUE MG/L	267.33	314.00	212.00	314.00
INGITION LOSS MG/L	88.33	114.00	66.00	78.00
TURBIDITY AS SIO2 MG/L	12.67	33.00	2.00	8.00
TOTAL HARDNESS MG/L	198.50	256.00	155.00	194.00
CHLORIDES MG/L	3.83	5.00	3.00	4.00
AMMONIA NITROGEN MG/L	0.57	0.80	0.30	0.60
SULFATES AS SO4 MG/L	56.33	64.00	46.00	56.00
NITRATE NITROGEN MG/L	0.57	0.90	0.40	0.50
TOTAL PHOS.AS PO4 MG/L	0.53	0.80	0.20	0.60
PHENOLS PPB	1.83	4.00	1.00	1.00
OILS AND GREASES MG/L	1.07	2.50	0.10	0.80
FLUORIDES MG/L	0.19	0.24	0.14	0.20
COLIFORM M.P.N./100ML.	384.83	1800.00	17.00	79.00
M.P.N. OF E COLI/100ML	8.63	17.00	1.80	7.40
STANDARD PLATE COUNT/ML	18183.	91000.	300.	2500.

SS2 SOUTH SASK. RIVER AT EMPRESS

DAY MONTH YEAR	13 NOV 1968	4 DEC 1968	8 JAN 1969	12 FEB 1969	4 MAR 1969
COMPOSITE OR GRAB SAMPLE	G	G	G	G	G
INITIAL SAMPLING TIME	1015	1800	1215	1350	1230
TEMPERATURE, DEG.CENT.	2.0	0.0	0.0	0.0	0.0
BAROMETRIC PRES. IN.HG	27.62	27.90	27.95	27.62	27.98
DISSOLVED OXYGEN, MG/L	12.0	11.7	6.6	6.4	6.5
PERCENT SATURATION	94.	86.	48.	47.	48.
BIOCHEM. OX. DEMAND MG/L	1.4	1.3	1.4	0.4	1.0
HYDROGEN ION CONC.,PH	7.9	8.3	8.0	7.8	7.7
ALKALINITY MG/L	134	141	195	168	162
THRESHOLD ODOR NO.,TYPE	4 M	8 M	4 M	4 M	4 M
TOTAL RESIDUE MG/L ,	268	272	302	302	266
IGNITION LOSS MG/L	74	94	102	62	76
TURBIDITY AS SIO2 MG/L	49	29	10	6	6
TOTAL HARDNESS MG/L	150	198	278	224	196
CHLORIDES MG/L	4	4	5	3	3
AMMONIA NITROGEN MG/L	0.5	0.3	0.8	0.9	0.4
NITRATE NITROGEN MG/L	0.3	0.5	0.4	0.5	0.6
SULFATES AS SO4 MG/L	50	60	72	68	58
TOTAL PHOS.AS PO4 MG/L	0.2	0.4	0.6	0.6	0.6
PHENOLS PPB	1	2	1	2	3
OILS & GREASES MG/L	0.2	0.1	8.9	1.7	0.7
FLUORIDES MG/L	0.40	0.34	0.15	0.17	0.19
COLIFORM M.P.N./100ML.	540.	240.	350.	350.	[illegible]
MPN OF E COLI/100ML	11.	9.	40.	2.	12.
STD. PLATE COUNT/ML	80000	750	500	1900	25000
RIVER DISCHARGE C.F.S.	6980.	3760.	2550.	3040.	2850.

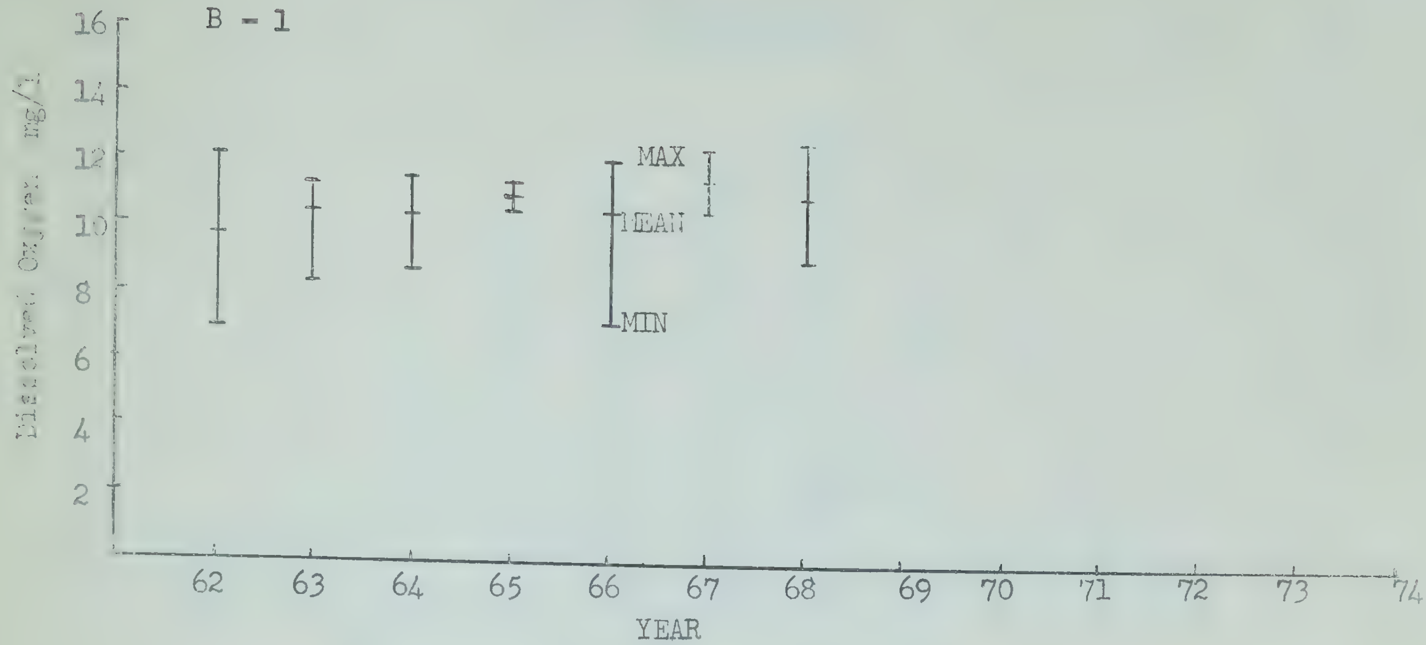
* DENOTES DATA NOT AVAILABLE

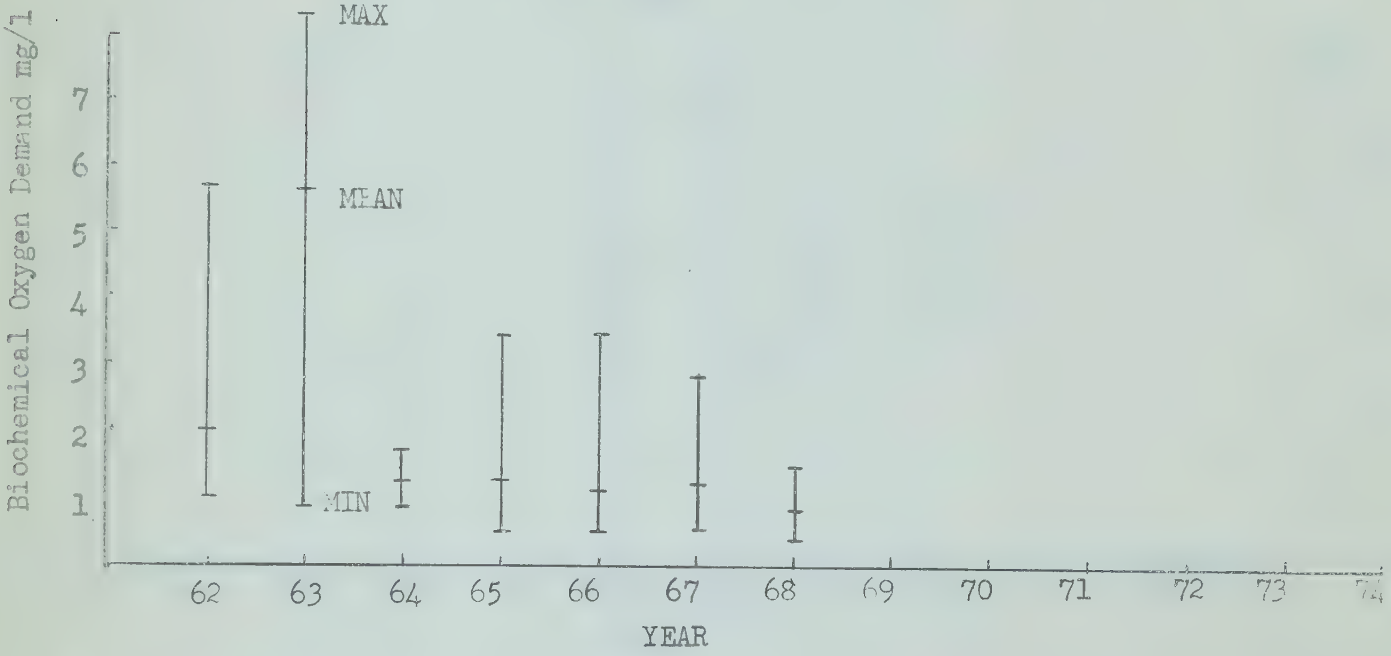
SS2 SOUTH SASK. RIVER AT EMPRESS 1968-69

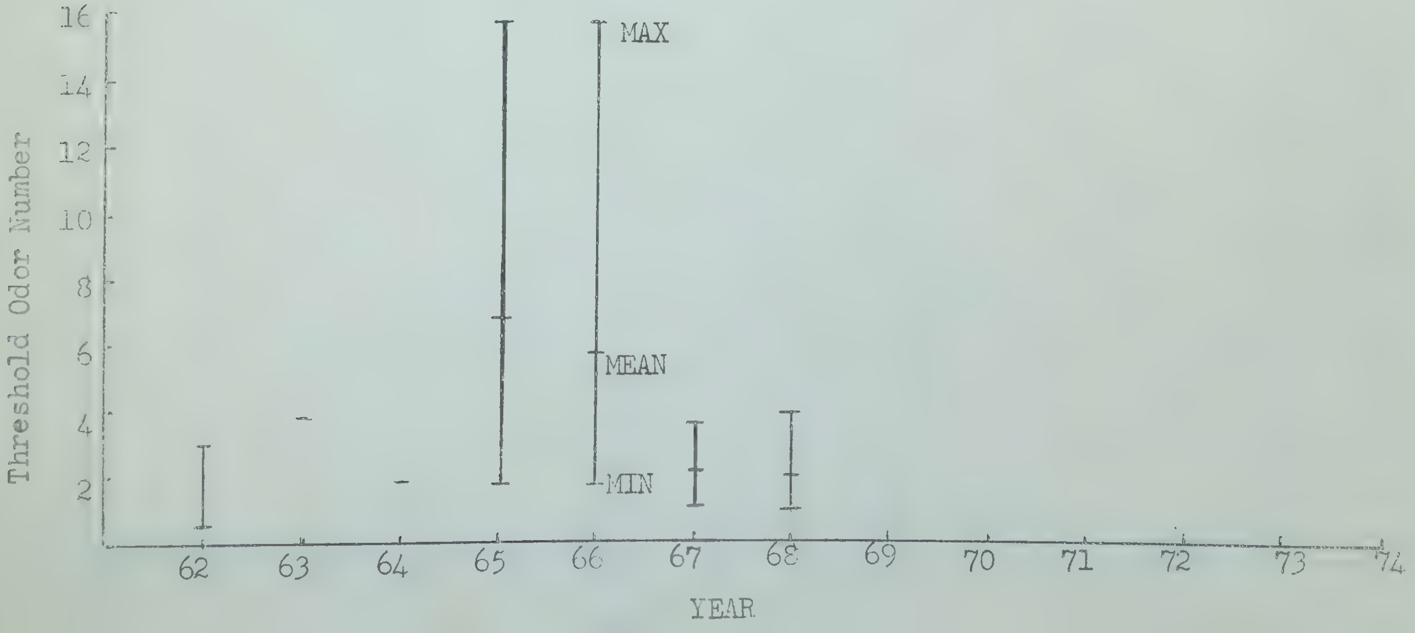
	AVERAGE	MAXIMUM	MINIMUM	MEDIAN
DISSOLVED OXYGEN MG/L	8.64	12.00	6.40	6.60
BOD MG/L	1.10	1.40	0.40	1.30
HYDROGEN ION CONC.,PH	7.94	8.30	7.70	7.90
ALKALINITY MG/L	160.00	195.00	134.00	162.00
TOTAL RESIDUE MG/L	282.00	302.00	266.00	302.00
INGITION LOSS MG/L	81.60	102.00	62.00	76.00
TURBIDITY AS SIO2 MG/L	20.00	49.00	6.00	10.00
TOTAL HARDNESS MG/L	209.20	278.00	150.00	198.00
CHLORIDES MG/L	3.80	5.00	3.00	4.00
AMMONIA NITROGEN MG/L	0.58	0.90	0.30	0.50
SULFATES AS SO4 MG/L	61.60	72.00	50.00	60.00
NITRATE NITROGEN MG/L	0.46	0.60	0.30	0.50
TOTAL PHOS.AS PO4 MG/L	0.48	0.60	0.20	0.60
PHENOLS PPB	1.80	3.00	1.00	2.00
OILS AND GREASES MG/L	2.32	8.90	0.10	0.70
FLUORIDES MG/L	0.25	0.40	0.15	0.19
COLIFORM M.P.N./100ML.	480.00	920.00	240.00	350.00
M.P.N. OF E COLI/100ML	14.82	40.00	1.80	11.00
STANDARD PLATE COUNT/ML	21630.	80000.	500.	1900.

APPENDIX B

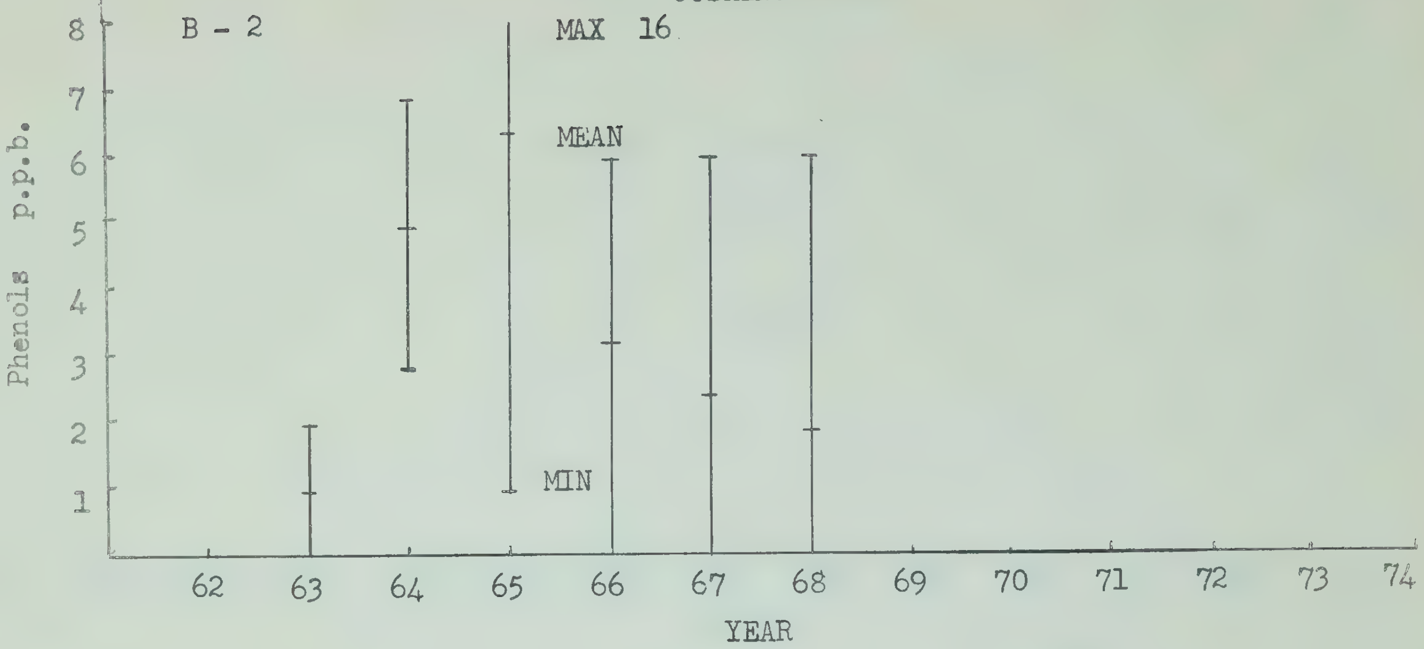
CUSHING BRIDGE

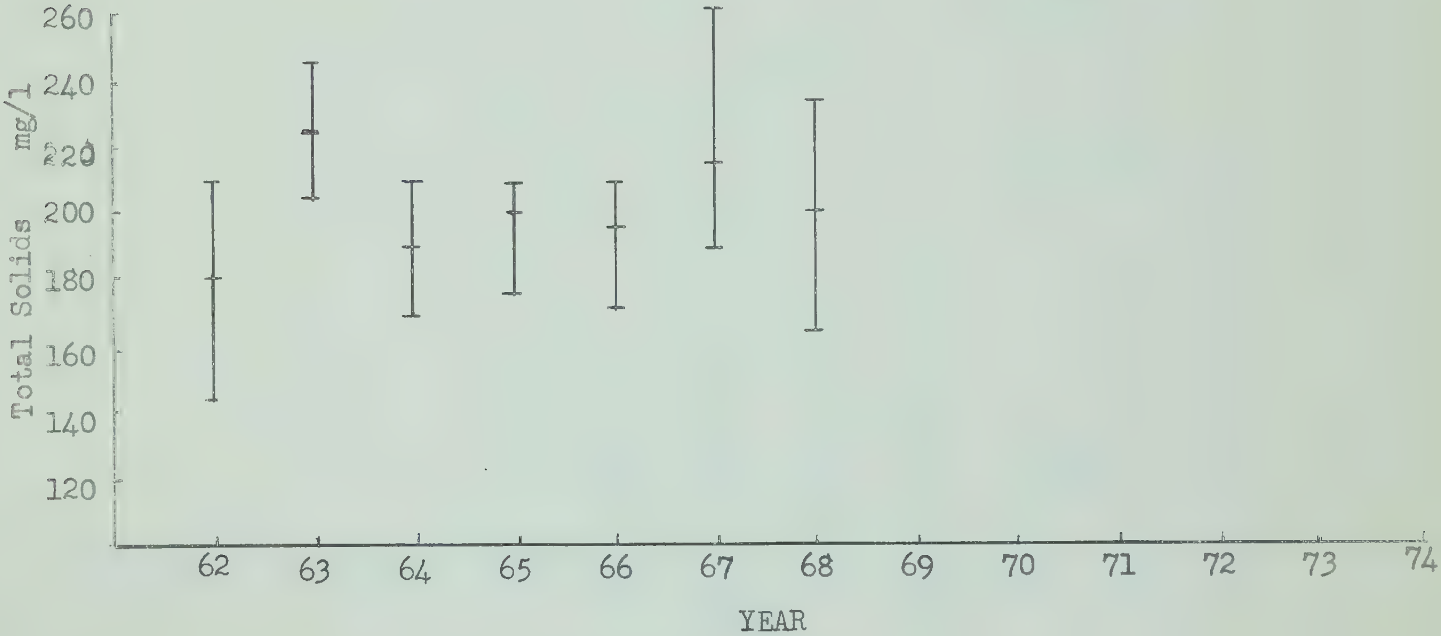


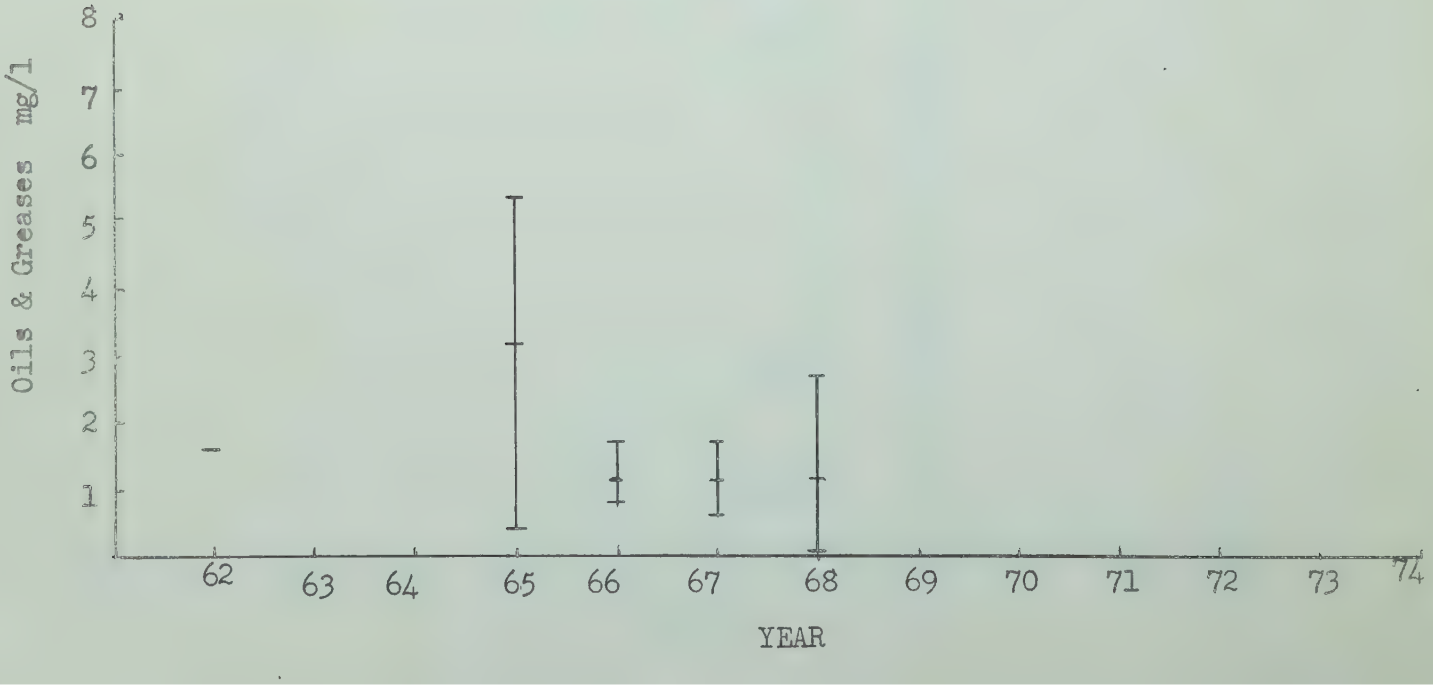




CUSHING BRIDGE

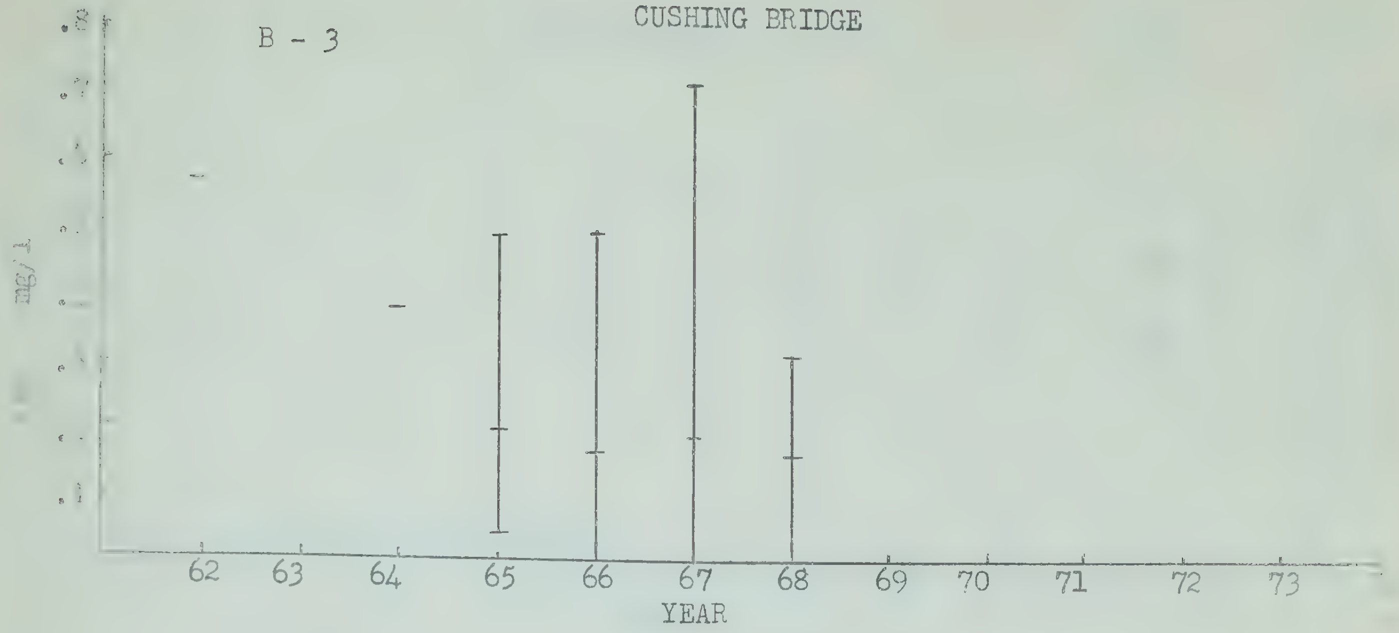


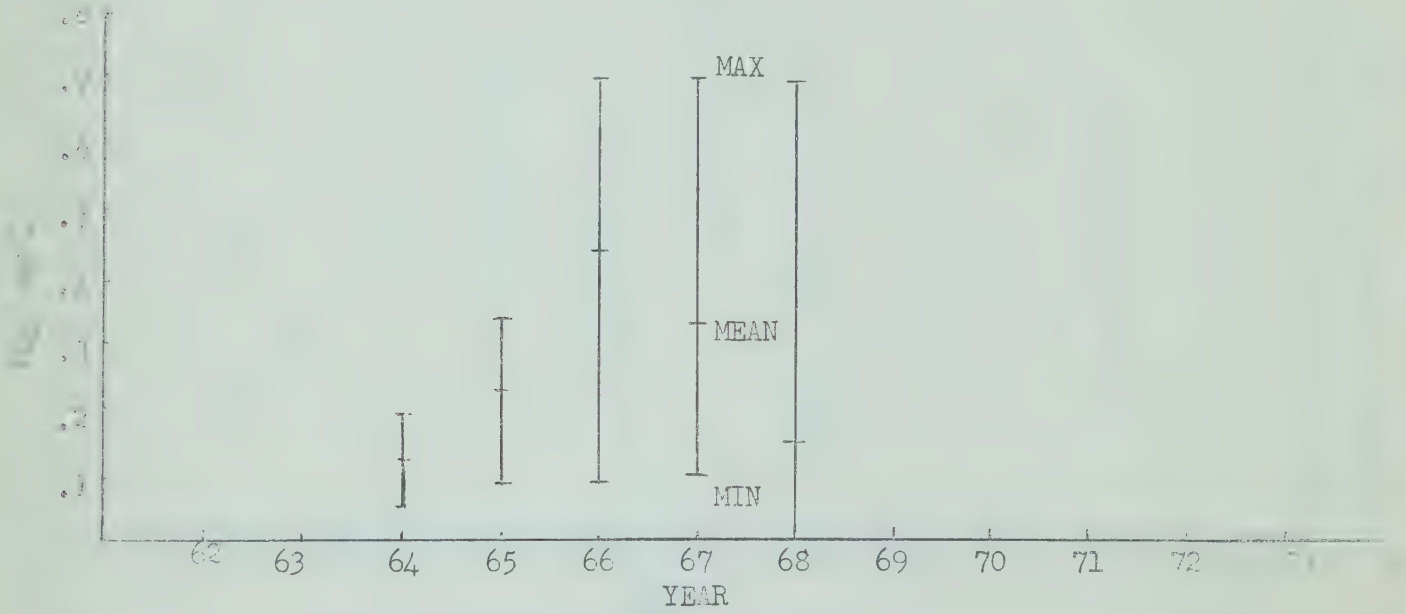




B - 3

CUSHING BRIDGE





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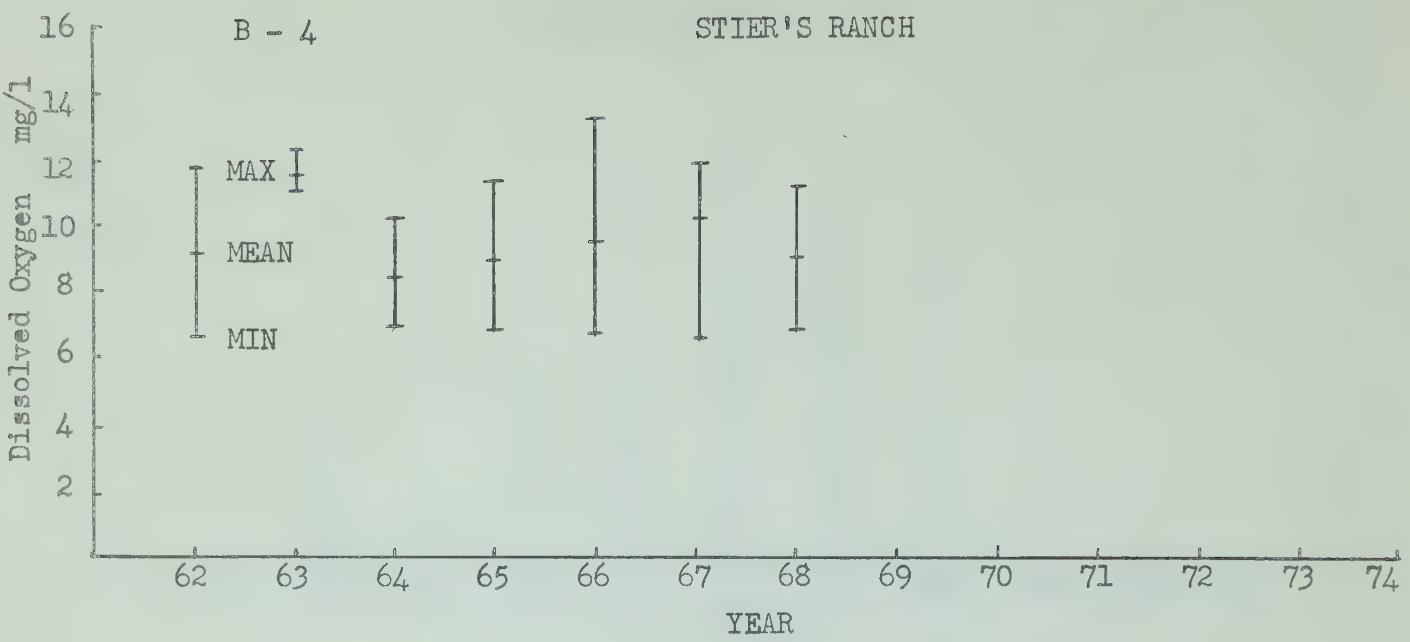
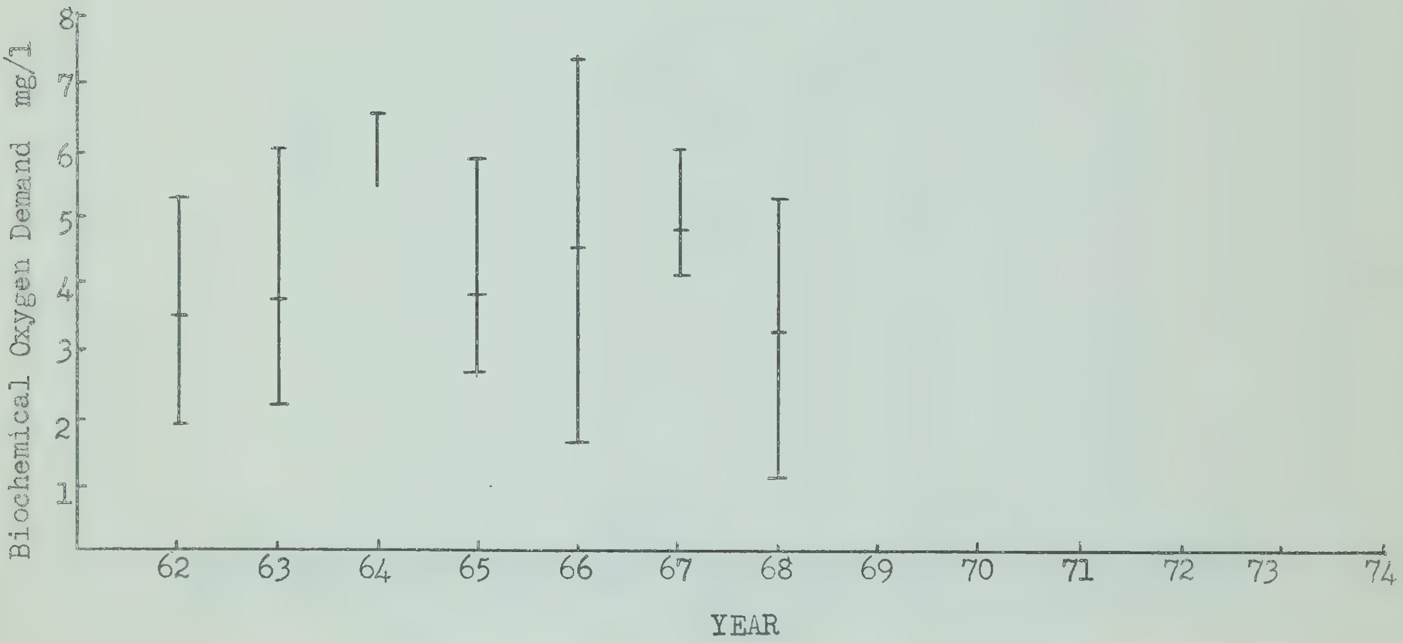
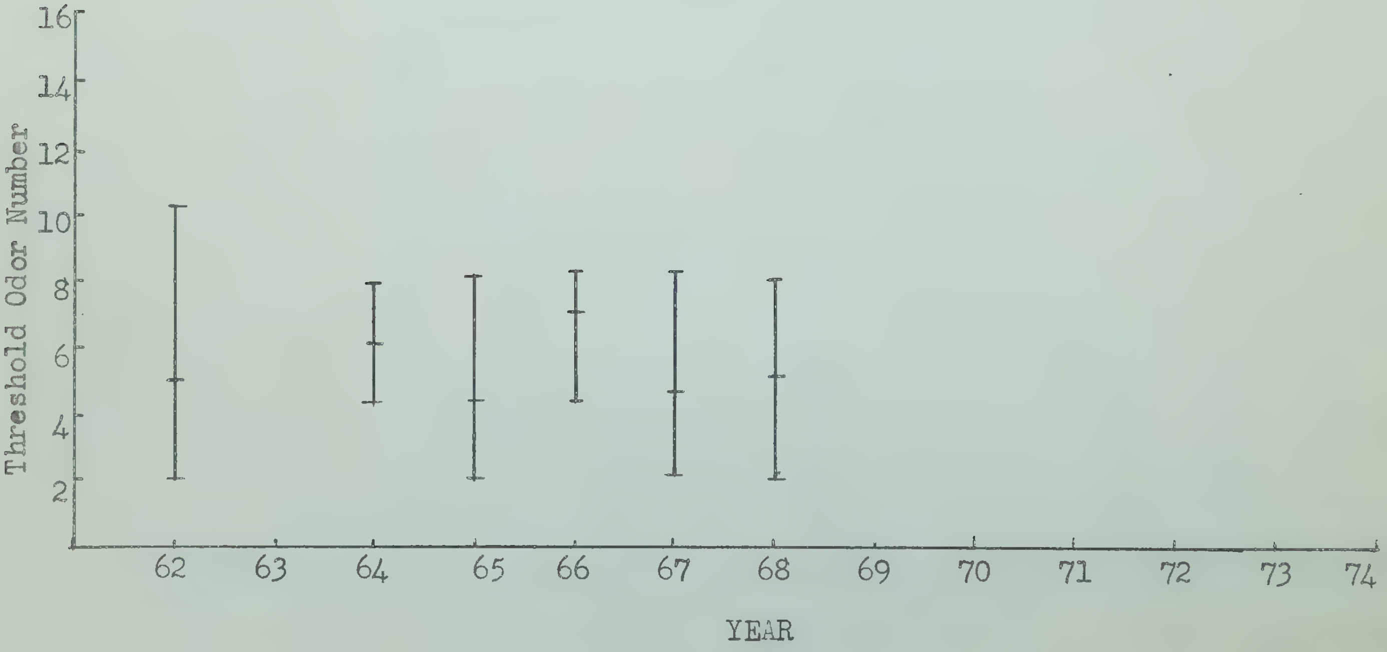
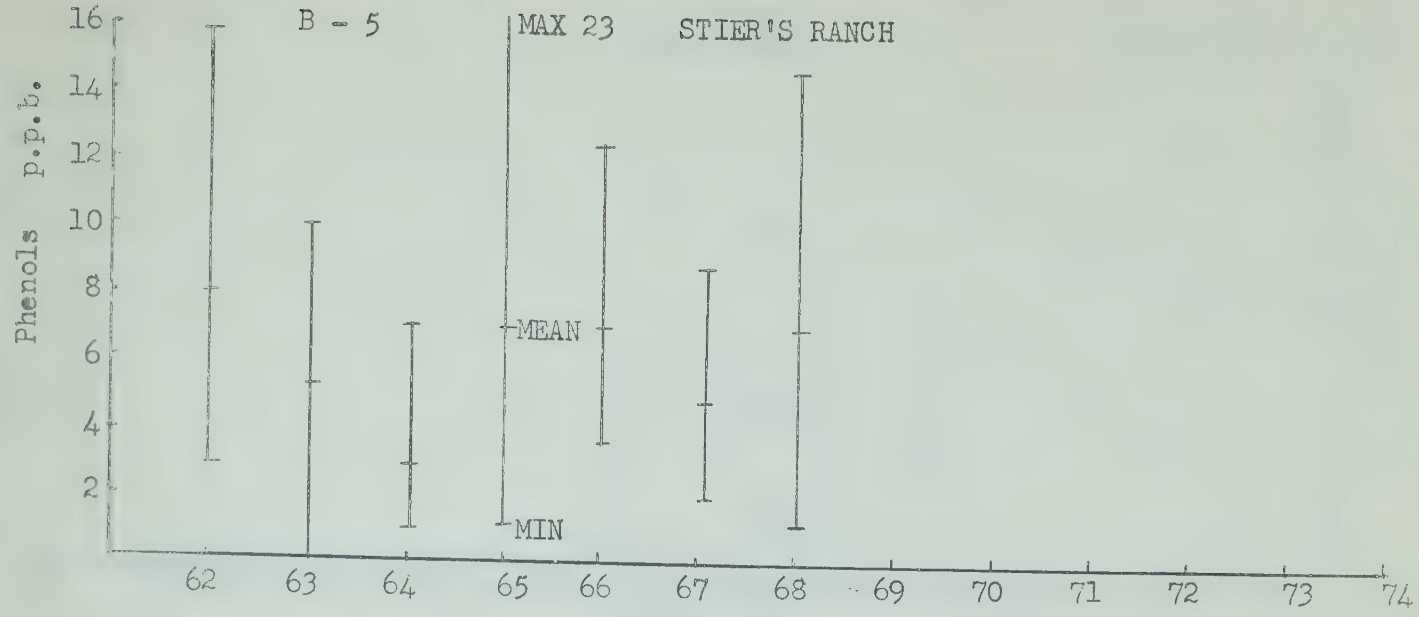
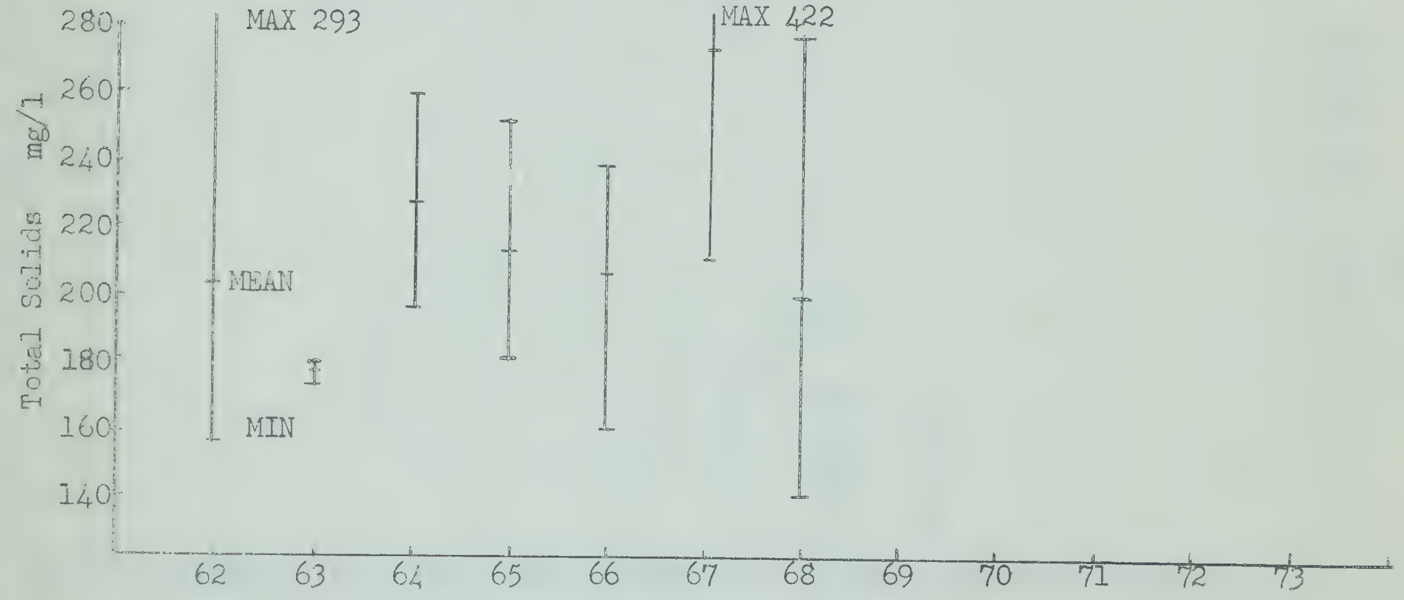







B - 5
STIER'S RANCH
MAX 23
MEAN
MIN
Phenols p.p.b.
16
14
12
10
8
6
4
2
62
63
64
65
66
67
68
69
70
71
72
73
74


MAX 293
MAX 422
MEAN
MIN
Total Solids mg/l
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200
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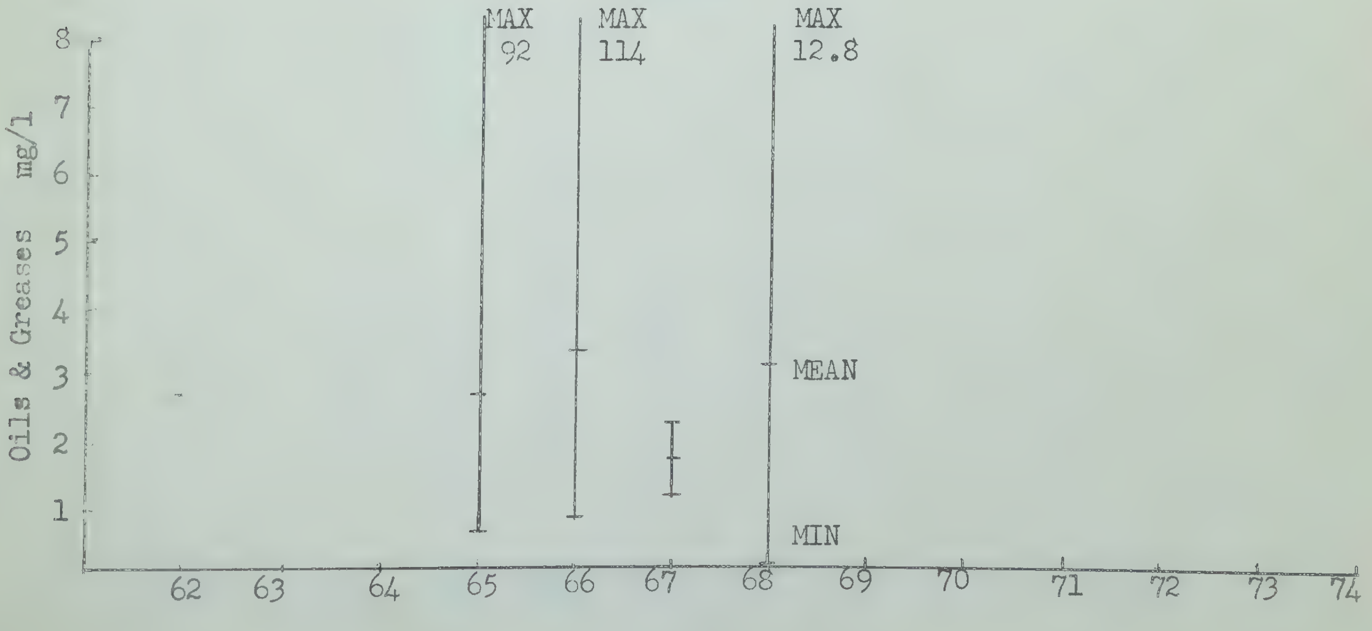
70
71
72
73


MAX
92
MAX
114
MAX
12.8
MEAN
MIN
Oils & Greases mg/l
8
7
6
5
4
3
2
1
62
63
64
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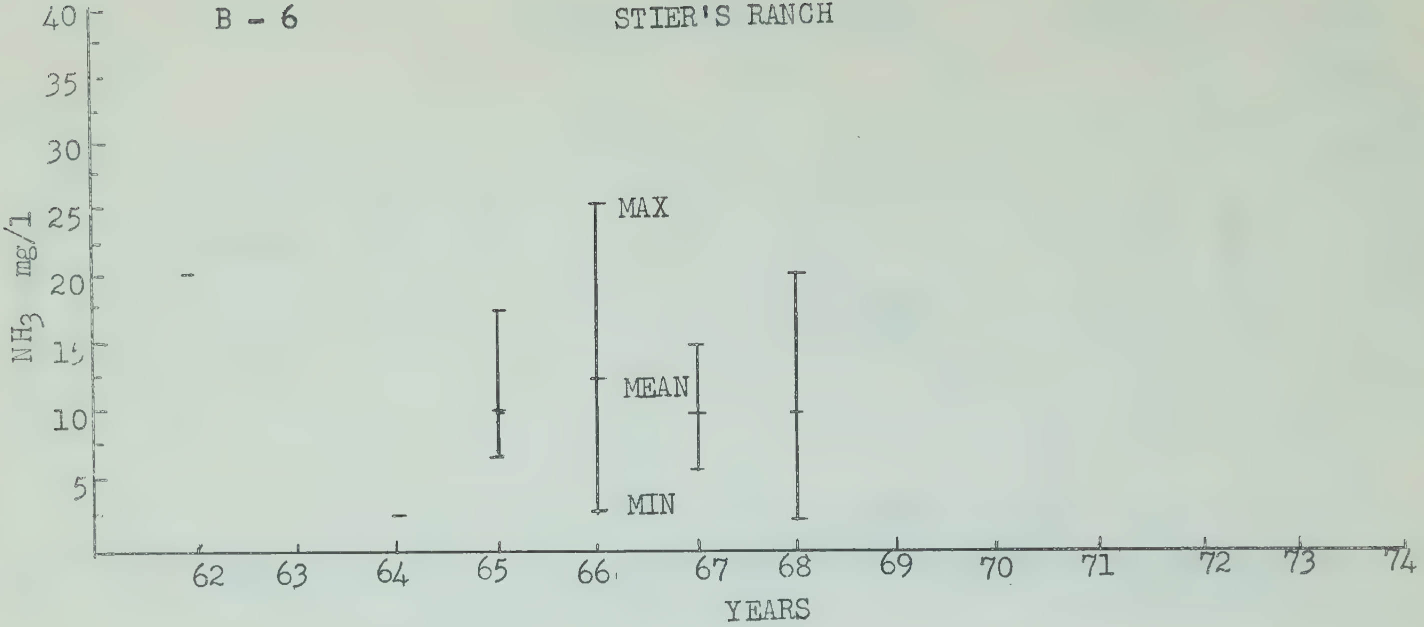
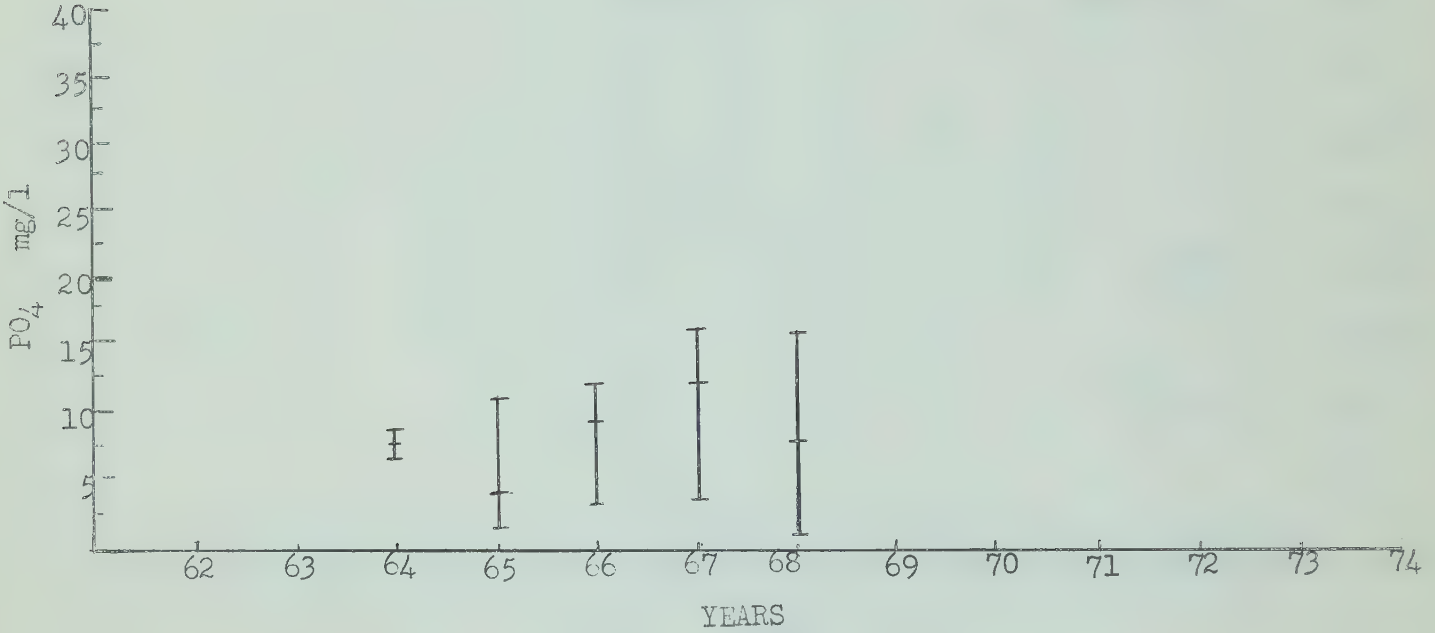
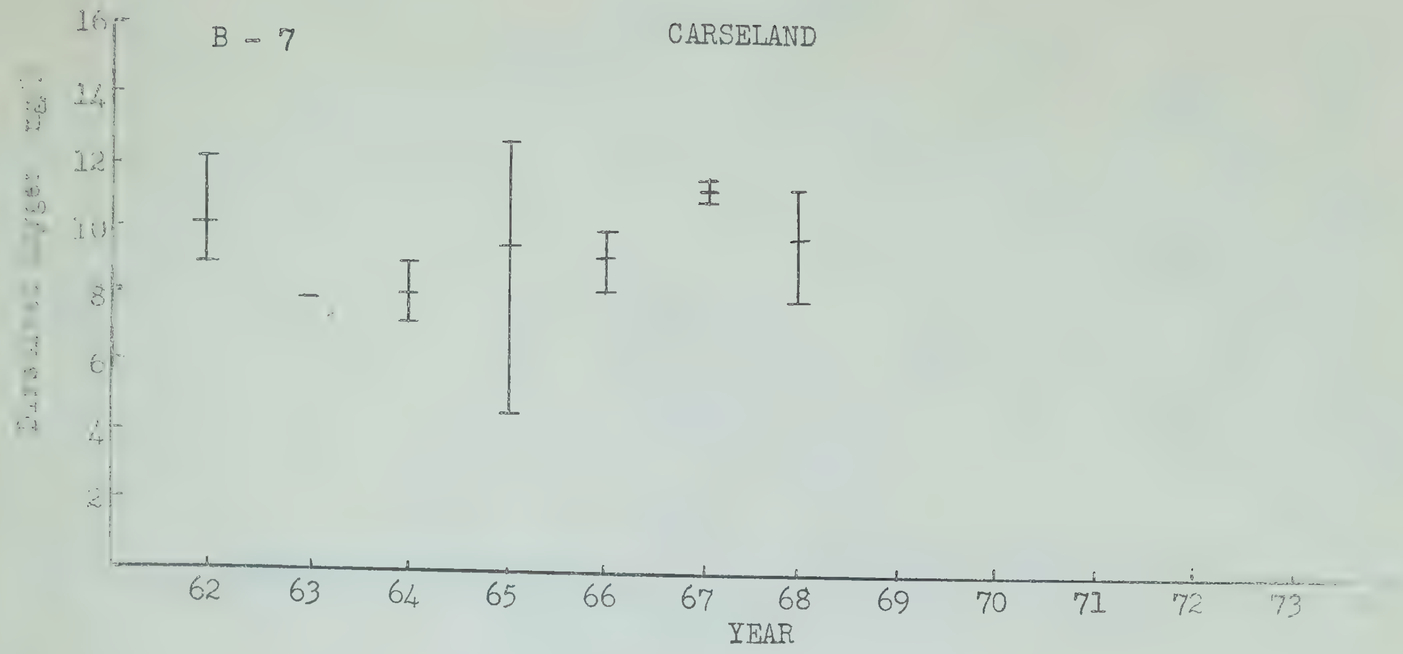
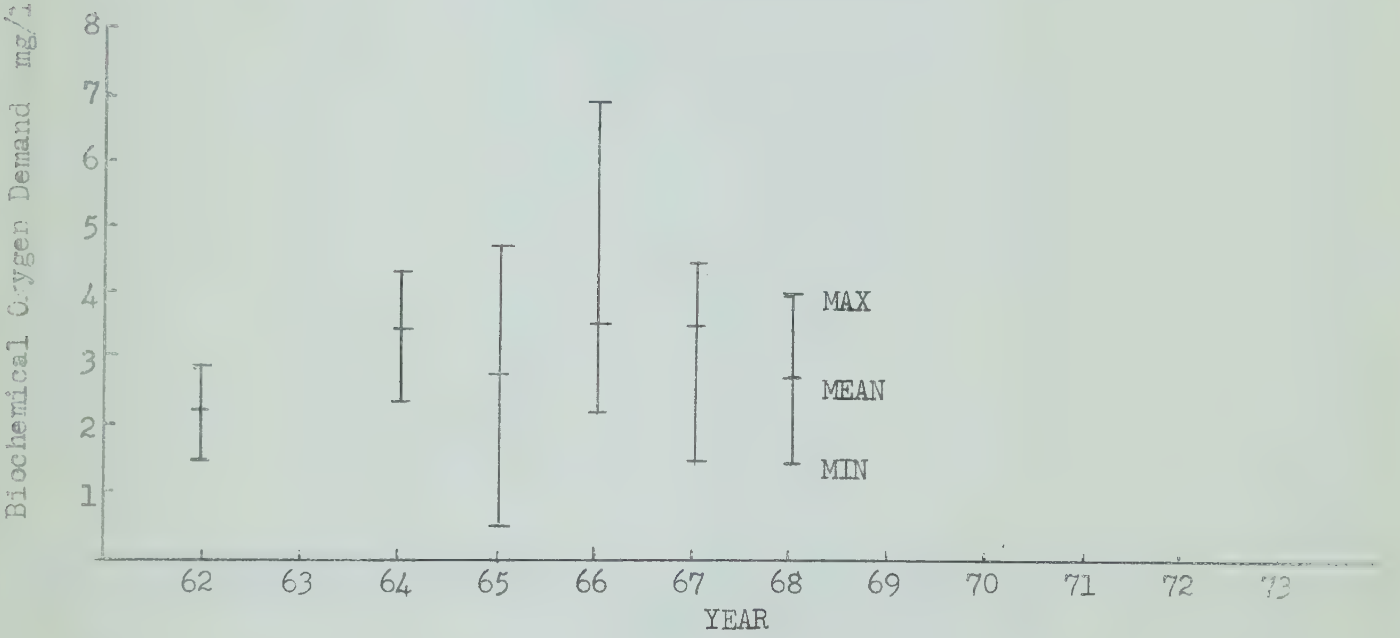
B - 6 STIER'S RANCH

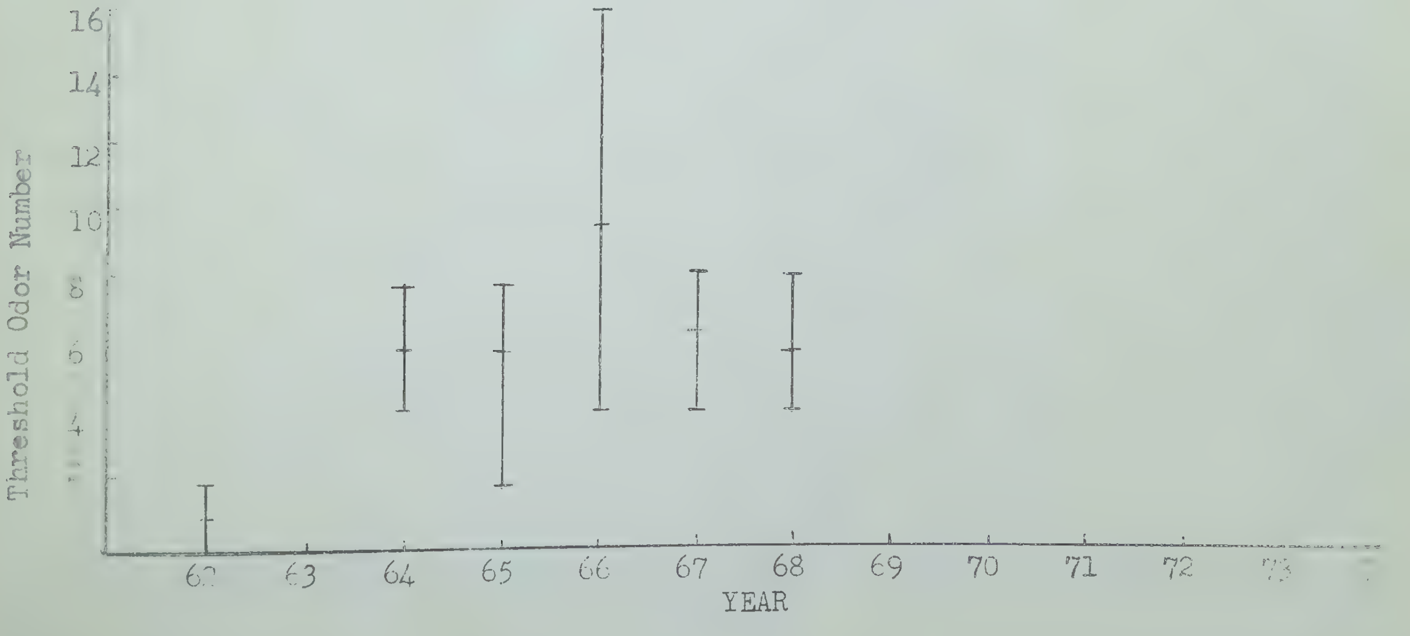




B - 7 CARSELAND







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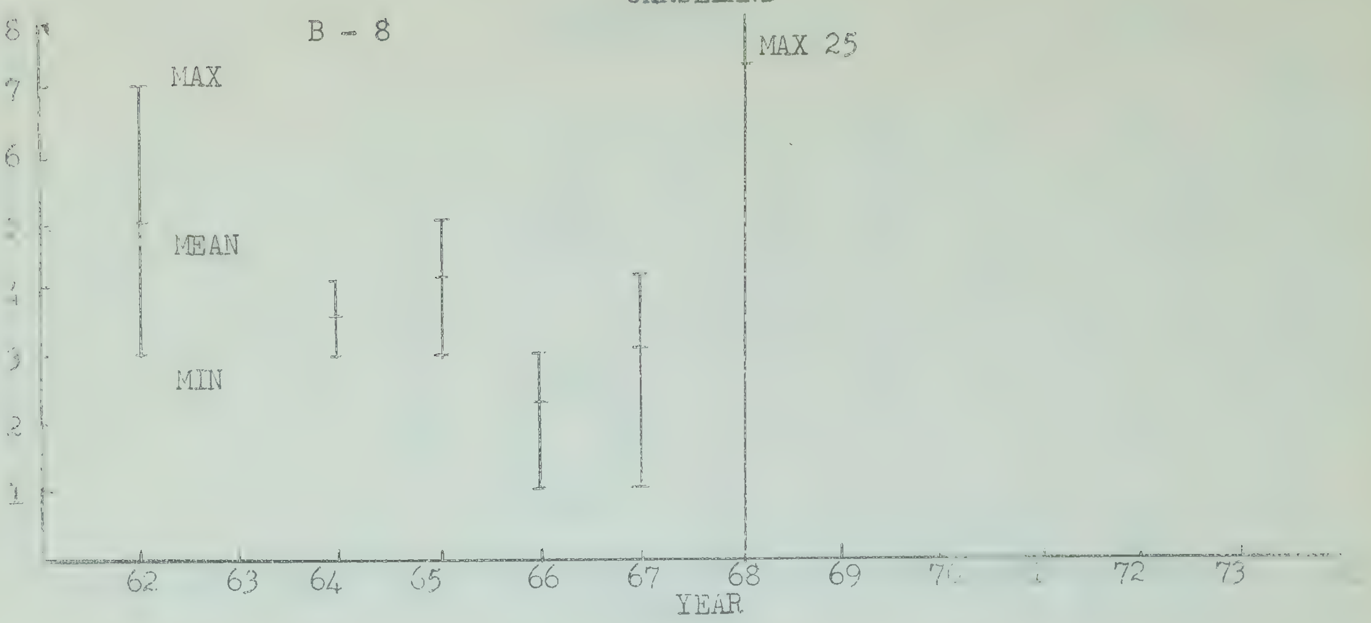
B - 8
MAX 25
MAX
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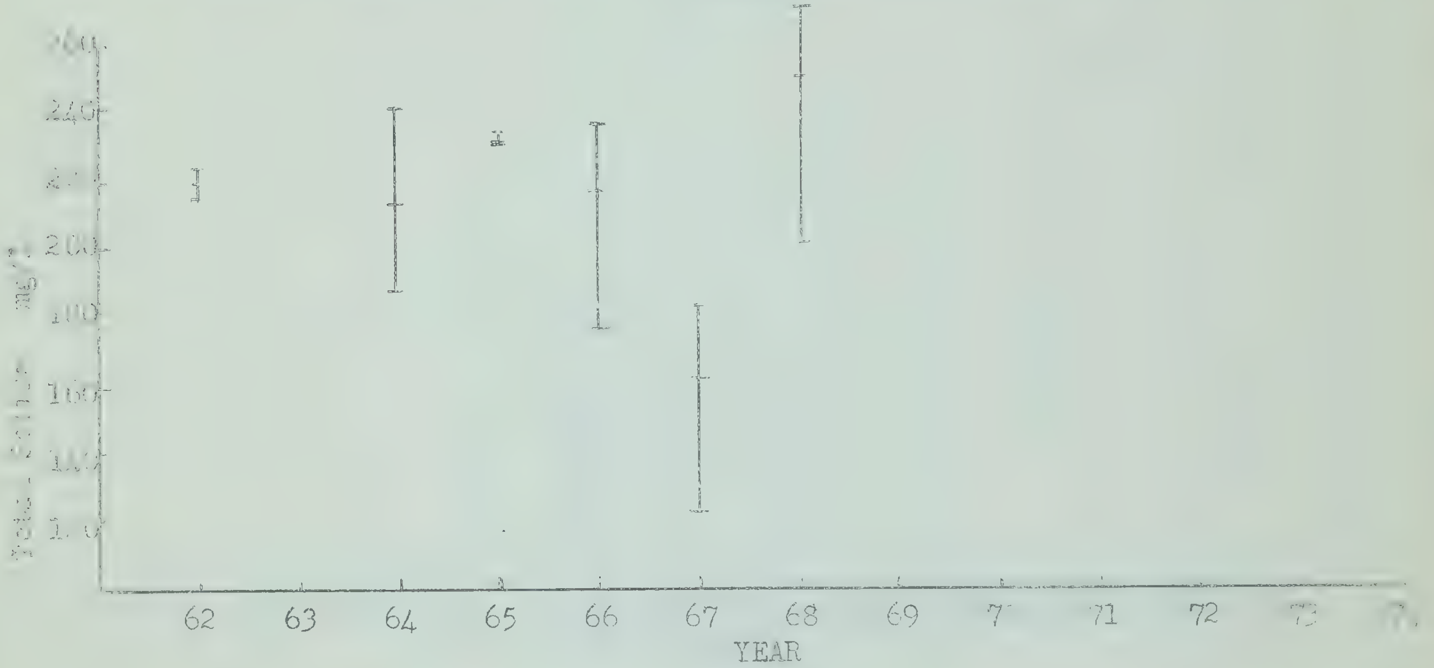
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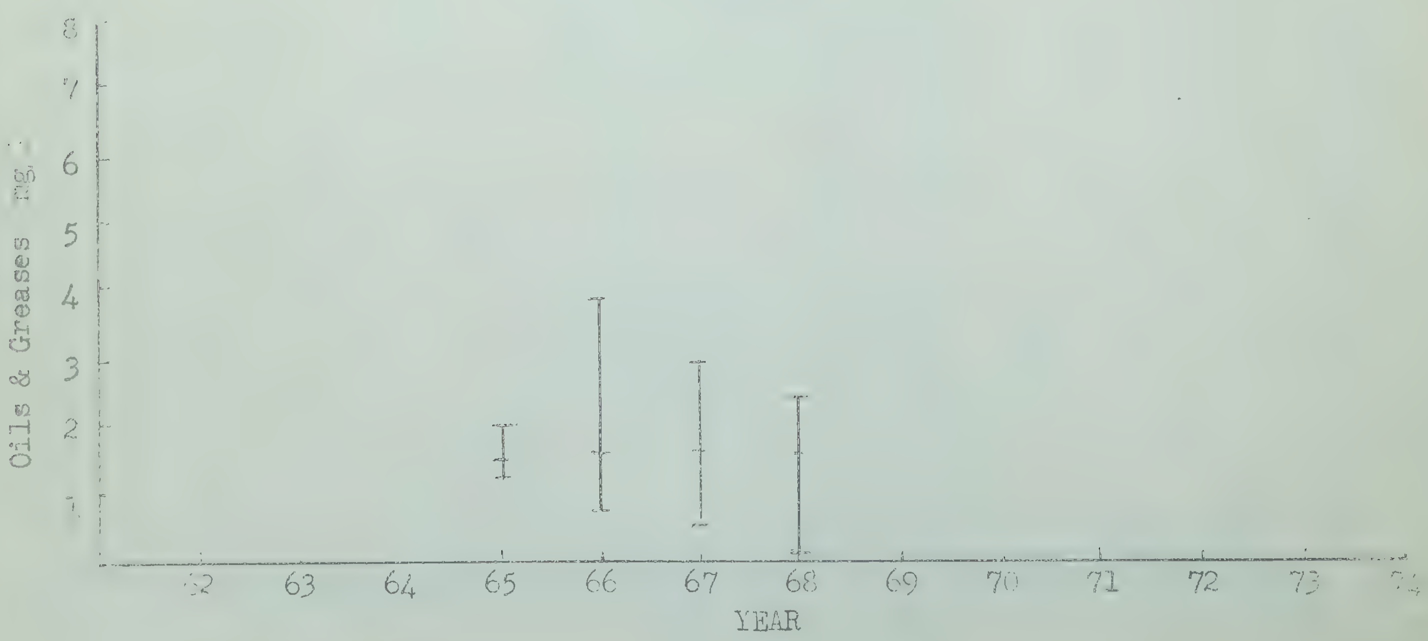
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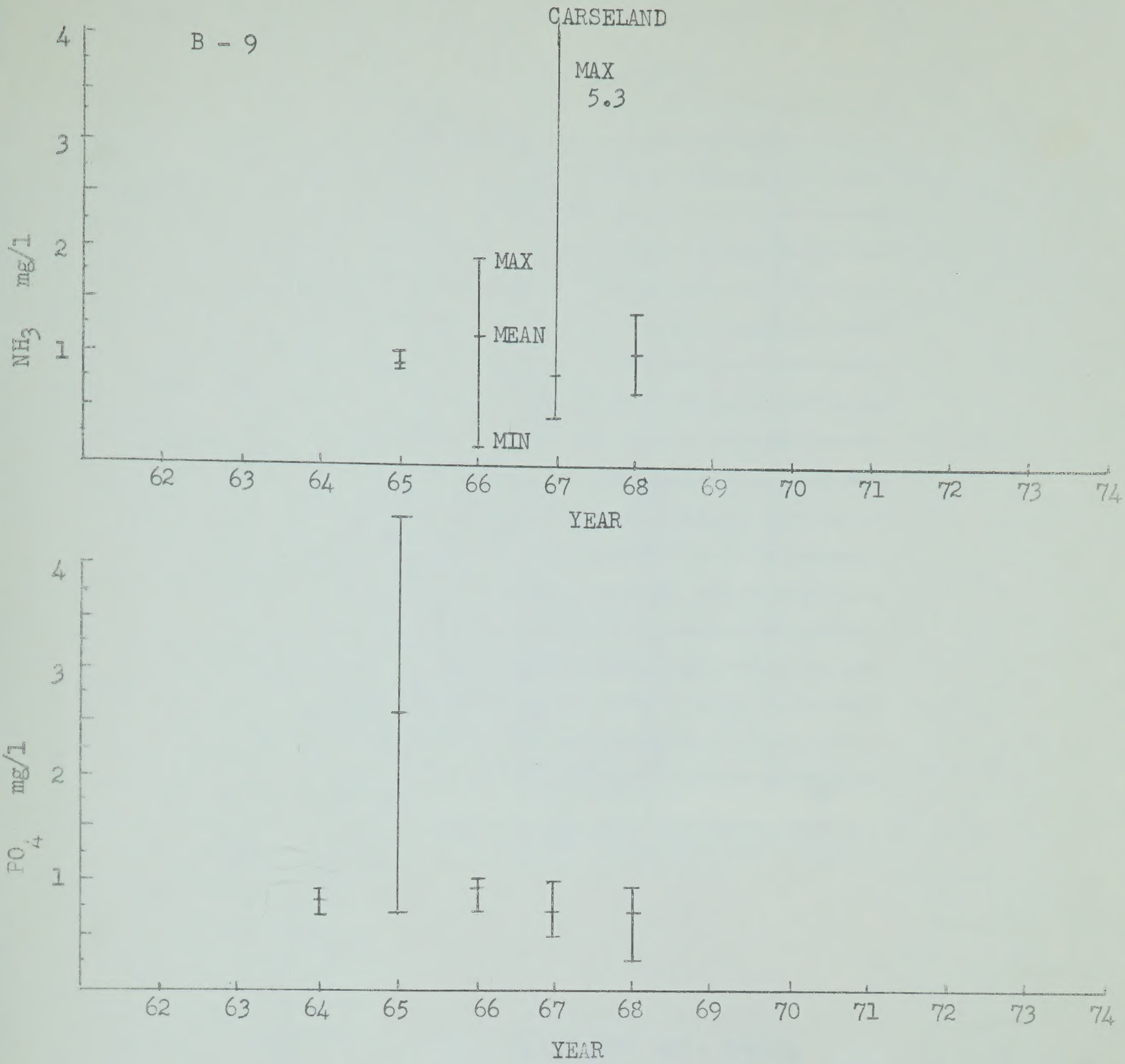
YEAR


CARSELAND
B - 9
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NH$_3$ mg/l
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73
74
YEAR
PO$_4$ mg/l
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